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Highway Safety Literature

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SAE: Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096. Order by title and SAE report number.

TRB: Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.



ABSTRACT CITATIONS

FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number ----- HS-013 124

Title of document ----- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY MALE AND FEMALE DRIVERS**

Abstract ----- The object of this research was to obtain data concerning the maximum amount of brake pedal force that automobile driver were able to sustain over a period of ten seconds. Subject were told to apply the brakes in the test car as they would in : panic stop, and to exert as much force as possible on the pedal over the entire ten second test period. A total of 84 subjects were tested, including 42 males and 42 females. The results indicated that there is a wide distribution of value which characterizes the pedal force that the subjects were able to generate. Male subjects produced generally higher force: than did females. Over half the women tested were unable to exert more than 150 lbs. of force with either foot alone, but when both feet were applied to the pedal, force levels rose significantly.

Personal author(s) ----- by C. R. VonBuseck

Corporate author (or author's affiliation) ----- General Motors Corp.

Publication date; pagination ----- 1973? ; 18p

Supplementary note ----- Excerpts from Maximum Parking Brake Forces Applied by Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are included.

Availability ----- Availability: Corporate author

NHTSA accession number ----- HS-013 165

Title of document ----- **FRICTION MATERIALS, THEIR CHARACTERISTICS AND METHODS OF USE IN BRAKES AND CLUTCHES**

Abstract ----- Properties of woven cotton, woven asbestos, sintered methods, and cements are given. Reasons for wear and brake fade are described. Different types of brakes and clutches are summarized.

Author statement ----- by Anonymous

Journal citation ----- Publ: Engineering Materials and Design

Publication date ----- 1973

Availability ----- Availability: Engineering Materials and Design v17 n4 p13-7 (Apr 1973)

HS-018 668

STATE PROGRAM ON ALCOHOL, CARBON MONOXIDE AND OTHER DRUGS AND THEIR RELATION TO HIGHWAY SAFETY

Blood specimens for 416 of the 714 Indiana driver fatalities during the period 1 Jul 1974-1 Jul 1975 were submitted by coroners and analyzed by the State Dept. of Toxicology. Fifty-four percent of the samples had ethanol in the blood, and 44% had a blood alcohol concentration (BAC) of 0.10% or above, evidence in Indiana of driving under the influence of alcohol. Methanol was found in four specimens, though not in the toxic range—greater than 0.2%—and sometimes in combination with ethanol. Barbiturates in a range causing sedation in most individuals were found in 2% of the specimens, and over half these specimens contained ethanol as well. Carbon monoxide concentration in an amount producing toxic symptoms in some individuals (concentrations causing 10% or more of the hemoglobin to form carboxyhemoglobin) was found in 13.5% of the samples. Of these 54% had ethanol concentrations of 0.10 or more. Most of the specimens came from rural area drivers, were seldom clotted, and ranged in volume from 1 to 30 ml, sufficient in all but 7% for all analyses.

by David J. Doedens; Robert B. Forney
Publ: Highway Safety Literature n76-1 pA1-2 (Feb 1976)
1976
Availability: See publication

HS-018 978

INCREASING SAFETY BELT USE THROUGH STRUCTURED EDUCATIONAL PROGRAMS--IS IT POSSIBLE?

Seat belt use can be increased by educational means. Using well-designed instructional objectives and content, and administered as a structured learning experience, such a curriculum could produce a 10% to 15% crash reduction rate for the graduates. The target audience should be beginning drivers whose accident rates account for 37.3% of all fatal crashes yet who are only 21.8% of the licensed driver population, and high-risk experienced drivers. A course description for a safety belt instructional unit is included. Obstacles to wearing seat belts are being overcome: seat belts in new cars are better designed and more often worn; and an instructional unit would achieve results unattainable by mass media spot campaigns. Use of the unit would result in better awareness of the need for safety belts; a low cost-per-pupil for the teenage group if driver training courses are used as the instructional base; and, based on projection of present statistics, a cost effectiveness of six lives saved per year at a societal cost saved of \$1,204,350.00, and 206 disabling injuries prevented each year at a societal cost saved of \$1,503,800.00.

by John D. DeLellis
Publ: Highway Safety Literature n76-4 pA1-12 (Apr 1976)
1976; 36refs
Availability: See publication

HS-019 038

ISSUES CONCERNING MEASUREMENT OF THE POPULATION AT RISK IN CRASHES

A great need exists for more accurate measures of exposure in highway safety statistics and statements. Exposure is defined as the amount or type of use by the population at risk. Without good measurement of exposure, it becomes impossible to determine accurately the other information needs of safety programming—frequency, relative severity, cause, and countermeasure effectiveness. Nine examples of statements using inaccurate exposure are given. There are three methods for estimating exposure. The gasoline sales method measures gas sold only to motor vehicles and converted to average mpg. Such a measure is confounded by numerous variables of usage. Resulting estimates are crude as they apply to areas only of state size or larger. It is inexpensive. The household interview method can relate mileage information to driver characteristics, vehicle type and community of residence, and it is inexpensive. However, difficulties arise in people interviewed estimating their mileage traveled and the proportion of such mileage devoted to differing uses. Further, this method gives no information about nonresidents driving in the area. The roadside survey method, with or without stopping vehicles, gives numbers and types of vehicles per hour on specific roads at specific times, and more personal information with stopped vehicles. This method is expensive. Furthermore, it is difficult to select enough sites over enough time frames to provide a truly representative sampling. Nevertheless, it provides the most accurate exposure data of the three commonly used methods. A fourth method is still in the experimental stage. Designated as the induced exposure method, it estimates the population at risk using information from highway crashes. It analyzes the innocent driver in a two-car crash, and the driver in a single-car crash. These drivers are presumed to be involved in crashes simply by exposure and they become measures of the population at risk. This method is cheap and accurate.

by Julian A. Waller
Publ: Highway Safety Literature n76-3 pA1-7 (Mar 1976)
1976; 15refs
Presented at Second National Forum on Traffic Records Systems, St. Louis, Mo., 16 Mar 1976.
Availability: See publication

HS-019 365

VALIDITY TEST OF NEW YORK STATE INJURY CODING SCHEME (NYSICS)

The New York State Injury Coding Scheme (NYSICS) was tested and found to be a more effective means of describing automotive accident injuries than the K-A-B-C injury scale previously used in the New York State Police Accident Report form and the National Standard System used nationwide. Instead of classifying injury by severity, the NYSICS uses numbers and letters to classify by location of the most severe complaint, type of physical complaint, and the victim's status. Limiting the description to numbers and letters minimizes writing out the injury description, eliminates policeman evaluation of severity, makes possible gathering more detailed information than previously possible, and permits easy capability for computer entry and retrieval. Two tests of the system were

conducted, one in which State police were informed of the testing, the other, to avoid bias, in which local police from various locations statewide used the system but were not informed of the testing aspect. In the first test, NYSICS was found easier to handle than narrative description, highly workable (of 152 police reports, 82 matched emergency room evaluation), and compatible with the Manual on Classification of Motor Vehicle Accidents. The second test results showed that in 83.9% of the 596 usable matched cases investigated, police opinion concurred with that of the hospital. The greatest opinion difference between hospital and police occurred with police diagnosis of burns and internal injuries. Continued use of the system should result in greater reporting accuracy. After testing, NYSICS was evaluated by the co-author of the Abbreviated Injury Scale (AIS), and after incorporating adjustments he recommended, the system was then translatable in 98% of the cases. This system will provide greater precision and uniformity throughout all police agencies statewide.

by Edwin S. Spence

Publ: Highway Safety Literature n76-6 pA1-10 (Jun 1976)

1976; 4rcfs

Availability: See publication

HS-019 662

ENGINEERING KNOW-HOW IN ENGINE DESIGN. PART 24. ECONOMY IN ENGINE PERFORMANCE

Four papers concerning fuel economy deal with agricultural equipment, a synthesized engine oil, optimization of car design, and the turbulent flow system for European 4-cylinder engines.

Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pa. 15096

Rept. No. SP-411; 1976; 56p

Includes HS-019 663-HS-019 666. Sponsored by the Milwaukee Section of the Society of Automotive Engineers, and presented at the 24th of its series of annual lectures, 1976. Availability: SAE

HS-019 663

ENGINE DEVELOPMENTS AND AGRICULTURAL EQUIPMENT FUEL CONSUMPTION TRENDS

Agricultural technology improvements over the last decade have resulted in substantial increases in both farm production and productivity. Most of these improvements have been made possible by the widespread acceptance of the diesel engine as prime mover for agricultural machinery. Today's "super tractors," backbone of the trend towards large farm operations, are all based on highly efficient diesel engines. The decrease in total agricultural fuel consumption over the last 20 years is the best testimony for the agricultural diesel engine. Short term improvements in engine and tractor efficiency should be based on further refinements of known techniques, with added emphasis in combustion control as well as volumetric and mechanical efficiencies. On a longer term, advanced fuel and air handling systems will allow combustion control for im-

proved engine-vehicle matches, resulting in further improvements in the energy efficient use of farm machinery.

by Jose F. Regueiro

John Deere Product Engineering Center

Publ: HS-019 662 (SP-411), "Engineering Know-How in Design. Part 24. Economy in Engine Performance," Warrendale, Pa., 1976 p1-10

Rept. No. SAE-760853; 1976; 20rcfs

Sponsored by the Milwaukee Section of the Society of Automotive Engineers, and presented at the 24th of its series of annual lectures, 1976.

Availability: In HS-019 662

HS-019 664

A SYNTHESIZED ENGINE OIL PROVIDING FUEL ECONOMY BENEFITS

Using synthesized hydrocarbon base fluids it is possible to formulate a light viscosity automotive engine oil providing economy benefits while avoiding the traditional oil condition and wear protection problems encountered with viscosity, conventionally refined mineral oil products. product, designated M-1, has been shown to provide significant benefits in the following critical performance areas: economy, oil economy, engine cleanliness, intake system cleanliness, wear protection, and cold starting capability. In the past, this level of performance has not been possible with conventionally refined mineral oils such as SAE 10W-4 SAE 10W-50. The superior performance of M-1 is demonstrated in extensive laboratory engine, chassis dynamometer and tests both in Europe and the U.S. Particular emphasis placed on extended duration API Sequence tests and EP/ economy testing. Engine oils formulated with a balanced combination of synthesized base fluids are completely compatible with mineral oils and have no detrimental effect on elastomeric seals commonly used in automotive engines.

by C. E. Goldmann

Mobil R and D Corp.

Publ: HS-019 662 (SP-411), "Engineering Know-How in Design. Part 24. Economy in Engine Performance," Warrendale, Pa., 1976 p11-21

Rept. No. SAE-760854; 1976; 22rcfs

Sponsored by the Milwaukee Section of the Society of Automotive Engineers, and presented at the 24th of its series of annual lectures, 1976.

Availability: In HS-019 662

HS-019 665

OPTIMIZING ENGINE AND CAR DESIGN FOR FUEL ECONOMY AND EMISSIONS

The fundamental relationships that exist among engine parameters, vehicle design factors, fuel economy and emissions are complex, but for any given emission control technology there is an inescapable relationship that exists between fuel economy and the exhaust emissions from the engine. The reason for this tradeoff is the interaction that exists between spark timing, air-fuel ratio, engine efficiency, and exhaust emissions. Fuel consumption, however, is affected not only by such engine control variables, but even more profoundly by the size and configuration of the car, these are based on customer requirements, and by vehicle formance, which includes the subjective requirement for drivability. The effects of the interrelationships among

parameters are complex and highly dependent on the specific powertrain components over an extremely broad range of load and speed. A detailed computer simulation of the engine-drive-train-vehicle system, General Purpose Performance and Economy Simulator Computer Program (GPSIM), provides reasonable first-order quantitative conclusions and has proved a useful guide when properly used. But in the real world, these engine characteristics are extremely sensitive to the way in which the ignition spark advance and air-fuel ratio vary throughout the operating load and speed range. Furthermore, the spark advance and air-fuel ratio must be tailored to meet the constraints of driveability, fuel octane number, and exhaust emission standards. Therefore, actual car tests were run with experimental vehicles using various displacement engines to truly depict the effect of emission standards and vehicle design parameters on performance. The results showed that emission constraints have a significant effect on fuel economy and can offset the gains which can be achieved through weight reduction.

by Donald L. Miles; George W. Niepoth
General Motors Corp., Engineering Staff
Publ. HS-019 662 (SP-411), "Engineering Know-How in Engine Design, Part 24. Economy in Engine Performance,"
Warrendale, Pa., 1976 p23-32
Rept. No. SAE-760855; 1976; 13refs
Sponsored by the Milwaukee Section of the Society of Automotive Engineers, and presented at the 24th of its series of annual lectures, 1976.
Availability: In HS-019 662

HS-019 666

EMISSIONS AND FUEL ECONOMY OF THE TURBULENT FLOW SYSTEM FOR EUROPEAN 4- CYL ENGINES

Testing of the Turbulent Flow System (TFS) on 4-cylinder European engines of approximately 2-liter displacement has produced some dramatic results that demonstrate the potential of lean-mixture operation as a route to lower automotive exhaust emissions with good fuel economy. The maximum cylinder-to-cylinder spread in air-fuel ratio is reduced by two-thirds. A power loss of only 3% is found with the TFM (Turbulent Flow Manifold), and this could possibly be eliminated by proper carburetor size. Tests by the Environmental Protection Agency (EPA) show that this system can achieve the levels of the Federal 1975-76 emission standards at a fuel economy equal to the sales-weighted data calculated by EPA for similar weight 1975 cars certified for the U.S. The TFS gave reduced emissions for the U.S. CVS (Constant Volume Sampling) and European ECE (Economic Commission for Europe) test cycles and showed benefits for two different engine families. Exhaust port liners or thermal reactors can provide significant unburned hydrocarbons and carbon monoxide reductions when used with the TFS.

by J. C. Hamilton
Ethyl Corp.
Publ. HS-019 662 (SP-411) "Engineering Know-How in Engine Design, Part 24. Economy in Engine Performance,"
Warrendale, Pa., 1976 p33-52
Rept. No. SAE-760856; 1976; 13refs
Sponsored by the Milwaukee Section of the Society of Automotive Engineers, and presented at the 24th of its series of annual lectures, 1976.
Availability: In HS-019 662

HS-019 667

SECOND GENERATION EYELLIPSE PROJECT. PHASES 1 AND 2. COMPARISONS OF DYNAMIC EYE POSITIONS IN A LABORATORY BUCK, STATIC VEHICLE AND ON-THE-ROAD VEHICLE. FINAL REPORT

In order to develop an Eyellipse (a three-dimensional description of drivers' eye locations) that can be used for various target locations and vehicle types, a screening experiment was conducted to identify factors that affect drivers' eye locations when viewing various off-center targets. Factors studied were driver height, driver sex, testing environment (static buck, static vehicle, on-the-road), eleven target locations, target repeatability and testing repeatability. Data were collected for the 1,980 eye locations using a recently developed remote coordinate system and a television data reducer. Height, testing environment, sex and target location are the significant factors that affect drivers' eye locations when viewing off-center targets. Regression analyses indicated that tall drivers' eyes are located to the right of shorter drivers' eyes when viewing center targets and targets to the vehicle's right. When viewing targets to the left of the vehicle, tall drivers' eyes are located further to the left than short drivers' eyes. In the on-the-road environment, drivers' eyes were located higher than when in the static vehicle. Eye locations in the static vehicle were higher than those in the laboratory buck. In addition, eye locations in the buck were further to the right than eye locations in the static vehicle or on-the-road. Testing repeatability had no systematic effect on drivers' eye locations. Results were found to be highly repeatable over the three test sessions. Variance of target repeatability was found to be less than that of test repeatability. Using analyses of variance, the height by sex, height by environment and sex by environment interactions were found to be significant. Targets located to the front and right of the vehicle were found to have more significant differences than targets located to the left of the vehicle.

by Ronald R. Mourant; Tong-Kun Pak; Effat Moussa-Hamouda
Wayne State Univ., Dept. of Industrial Engineering and Operations Res., Detroit, Mich. 48202
1976; 89p
Availability: Motor Vehicle Manufacturers Association

HS-019 668

SAFER SIGN AND LUMINAIRE SUPPORTS--TASK K. CORRELATION OF FULL-SCALE, LABORATORY, ANALYTICAL, AND COMPUTER-SIMULATED RESULTS

Five series of tests were performed on a variety of luminaire support specimens: an 8WF20 I-beam; a 30-ft steel support; a 30-ft aluminum support; a 40-ft steel support; and a large dual-legged support, the only specimen on which full-scale tests were performed. The tests involved a 2250-lb pendulum mass at 20 mph. In each series analytical and computer simulation tests were performed. The impact was separated into three phases: momentum change due to crushing the vehicle, momentum change due to the base reaction force during slippage, and momentum change due to inertial properties of the structure. Correlation among the three types of testing was good; provided proper input characteristics for car and sign support are given, the simulation (and analytical approach) predict the full-scale performance quite well. In general, the computer

simulation is more accurate than the analytical approach since the latter treats the sign support as a continuous beam (ignoring the hinge action) and also ignores the presence of the sign blank.

by R. P. Owings; J. W. Adair; T. J. Rudd
 ENSCO, Inc., Transportation and Instrumentation Sciences
 Div., 5408A Port Royal Rd., Springfield, Va. 22151
 Contract DOT-FH-11-8118
 Rept. No. FHWA-RD-76-35; 1976; 60p
 Availability: NTIS

HS-019 669

COOPERATIVE STUDY OF HEAVY DUTY DIESEL EMISSION MEASUREMENT METHODS

Test procedures and equipment being proposed by the Environmental Protection Agency (EPA) for heavy-duty diesel emissions are compared with other systems currently in use. Six laboratories participated in a series of eight tests using a multicylinder engine as the emission generator. The study's primary emphasis was on nitric oxide (NO) and oxides of nitrogen (NOx) measurement methods and instrumentation. Carbon monoxide, carbon dioxide, and hydrocarbon measurements were made by two participants using complete sampling and analysis systems. The various NOx instrument configurations used included vacuum and positive pressure chemiluminescent (CHEMI) analyzers and a modified NDIR. Equivalent NOx results were obtained with the different systems when measuring brake specific emissions on a modified 13-mode heavy duty diesel emission measurement cycle. NOx measurements were more consistent than NO measurements. System response time had an effect on measured NOx values with longer response times resulting in lower measured values. When sample delivery times were kept similar, sample line lengths of 10 to 50 ft did not significantly affect measured values. Sample lines constructed of stainless steel, polypropylene, or Teflon did not significantly affect the measured values in these tests. Sample system temperatures can affect NO values but show little or no effect on NOx over the range of temperatures in these tests (just above dew point 110° - 375° F). For the eight test series, the reproducibility of agreement between the participants ranged from 1.0 to 5.3% for BSNO (brake specific nitric oxide) data based on NO measurements and 0.45 to 3.2% based on NOx measurements. Overall repeatability and reproducibility was excellent when compared to previous data. The major problem encountered in this study was the observation, in some cases, of NO values greater than NOx values which occurred more frequently in the dry systems using the high temperature stainless steel converters.

Coordinating Res. Council, Inc., Gaseous and Particulate
 Emissions Panel, 30 Rockefeller Plaza, New York, N.Y. 10020
 1976; 86p 8reft
 CRC Proj. CAPI-1-64.
 Availability: SAE

HS-019 670

AN ASSESSMENT OF THE EFFECTIVENESS OF THE FOLLOWING-TOO-CLOSELY MONITOR

a point on the roadway that the rear of the leading vehicle has just passed) and presents a message to the following motorist if the time gap is improper. A "violation" message is flashed if the time gap is 0.70 seconds or less, and a "danger" message is presented if the time gap is between 0.70 seconds and 1.25 seconds. The FTC system used in this study was installed in Raleigh, N.C., on South Wilmington St., an urban four-lane divided roadway carrying approximately 30,000 vehicles a day. Two FTC signs were installed at a single southbound location (one for each lane), while the northbound lanes served as a control. The rear-end accident data for South Wilmington St. fluctuate so widely over the four-year study period that it is not possible to definitely quantify the FTC effort, and no formal benefit-cost ratio is possible. For the southbound direction, a straight line projection indicated that the number of rear-end crashes occurring in the year after FTC installation were precisely what would have been expected had there been no signs installed. However, a straight line projection developed for the ratio of the southbound rear-end accidents to the control street rear-end accidents indicated a 28% reduction in the observed ratio when compared to the expected ratio. In terms of the time gap data, a reduction in the percentage of "violation" and "danger" occurrences was observed in the southbound lanes after the FTC was installed. The largest reduction occurred at the station located immediately downstream from the sign location with smaller decreases at two stations farther downstream which were located beyond a signalized intersection. The enforcement phase had no appreciable effect on the gap time data, probably because police coverage was minimal (less than 10 hrs/week) and warnings rather than citations were issued to offenders. Improper gap time incidents grew when signs were covered and fell when signs were reactivated. Some delays resulted from equipment-related problems but those problems were minor. The city should continue the operation of the signs and the collection of rear-end accident data until the effect can be quantified more fully.

by William W. Hunter; Henry L. Bundy; Robert B. Daniel
 University of North Carolina, Highway Safety Res. Center,
 Chapel Hill, N.C.
 1976; 103p 11reft
 Availability: Corporate author

HS-019 671

VISIBILITY DISTANCE THROUGH HEAT ABSORBING GLASS

The distances at which pedestrians are first detected by drivers looking through clear and heat absorbing glass were determined with the aid of a headlight visibility program (HVP). This program is capable of determining the effects of many vehicle and environmental factors on visibility distance because it carefully models the following: the human visual detection process, the illumination provided by vehicle headlamps, road topography and perspective geometry, pavement reflectivity, the disabling effects of glare on target detection, windshield transmissivity, headlamp misaim, and headlamp dirt. The percent variation in detection distance between clear and heat absorbing glass ranges from 0 to 107%. But the HVP also copes with additional complicating factors that are often significantly greater than the variation in detection distance due to the type of windshield glass. The decrea-

the pedestrian has a low reflectance, the most intense headlamp illumination is directed at the pedestrian's feet, and there is no glare. Under most circumstances the decrement in visibility distance due to heat absorbing glass is only 6%. Headlamp dirt is a serious factor adversely affecting detection distance. Decrements in light transmission of 15, 45, and 75% were quite prevalent under dry, wet, and slushy road conditions, respectively. Whereas the decrement in detection distance to a 15% reflective pedestrian due to heat absorbing glass is 16 ft the expected decrement in detection distance when road conditions change from dry to wet (a 30% reduction in light transmission) is 40 ft. The use of headlamp washers would increase detection distance enough to more than compensate for the reduction in detection distance caused by heat absorbing glass. Headlamp misaim is another vehicle factor seriously affecting detection distance. If both low beam headlamps are misaimed down 0.8° corresponding to a variation in the aim of each headlamp, detection distance will diminish by 32%. Heat absorbing glass reduces visibility distance to a white reflectorized delineation line by only 4.8%. This reduction should not adversely affect the driver's guidance and lane maintenance ability. Road topography affects visibility distance significantly, and while headlight beams are on low, pedestrians on the right side of the road are more easily detected than those in the center or on the left. Changes in grade can produce 350-ft variations in detection distance.

by Arthur Bernstein

University of Michigan, Highway Safety Res. Inst., Ann Arbor, Mich. 48109

Contract DRDA-76-1021-KB1

Rept. No. UM-HSRI-76-17; 1976; 39p 14ref.

Availability: Corporate author

HS-019 672

A CASE OF FUNCTIONAL HYPOGLYCAEMIA OHYPOGLYCAEMIA--A MEDICO-LEGAL PROBLEM

A woman unknowingly afflicted with hypoglycemia was the driver involved in a hit and run accident and had no memory of it. Briefly, her history is as follows: 42 years old, a nurse and social worker, married to a doctor, a citizen of excellent character, anxious about her husband because of coronary thromboses he had suffered and she therefore a sometime user of sedatives (alcohol) and amphetamines. Symptoms of the disease were confused by her friends, neighbors, and herself to be results of her drug use and anxiety, and hypoglycemia was not diagnosed easily. She sometimes exhibited uncharacteristic behavior: irritable to the point of verbal belligerence with a paranoid flavor; failure to concentrate and subsequent amnesia; tremor, sweating and nausea; a state of detachment and lack of time sense; episodes of exhaustion, irritability, anxiety and depression; often a general feeling of being unwell. Hypoglycemia was diagnosed after a prolonged stay in the hospital and following physical and psychological testing. The extended sugar tolerance test showed a clear correlation between low blood sugar levels and abnormal cerebral function as well as her subjective feelings of illness. At low blood sugar levels, alterations in behavior and abilities were noted, the patient drifted easily into sleep and experienced feelings of illness. With a blood sugar below 70 mgm she had difficulty with simple calculation and in answering simple quiz type questions to which she knew the answers; below 50 mgm she was unable to recite nursery rhymes. But it was only when the blood sugar reached 44 mgm that she became slightly ataxic.

incoordinated and unable to perform automatic movements. At the end of testing, the patient seemed unaware of the length of time that had passed (a little over 4.5 hours). At her trial only medical evidence was used by the defense lawyer, and after hypoglycemia was proved, she received only a nominal fine and driving disqualification for seven years.

by Diana Bovill

Publ: British Journal of Psychiatry v123 p353-8 (1973)

1973

Availability: See publication

HS-019 673

HIGHWAY ACCIDENT REPORT. SURTIGAS, S.A., TANK-SEMITRAILER OVERTURN, EXPLOSION, AND FIRE, NEAR EAGLE PASS, TEXAS, APRIL 29, 1975

At 4:20 p.m., a Surtigas, S.A., tractor-tank-semi-trailer, west-bound on U.S. Route 277 near Eagle Pass, Tex., swerved to avoid an automobile ahead that was slowing for a turn. The tank-semi-trailer separated from the tractor, struck a concrete headwall, and ruptured; vaporized LPG (liquid propane gas) was released. The ensuing fire and explosion destroyed a building and 51 vehicles. Fifty-one persons in the area were burned and 16 persons, including the truck driver, were killed. The National Transportation Safety Board (NTSB) determined that the probable cause of this accident was the evasive action taken by the truck driver to avoid a slowing vehicle in his path of travel. The cause of the fatalities and injuries to persons in the vicinity was the explosive force and fire, from which they had no time to escape. The rapid development of the explosive force and fire was caused by the gross rupture of the tank. As a result of its investigation of this accident, the NTSB made recommendations to the Federal Highway Administration (FHA) to promulgate a regulation making the criteria established in the Handbook of Highway Design for Operating Practices mandatory for all modified and new designs; and to compile and evaluate accident data related to unprotected, raised concrete headwalls, and sidewalls that, because of their location, are roadside fixed objects, to determine whether added emphasis for their modification or protection is warranted. To the Texas State Dept. of Highways and Public Transportation, the NTSB recommended conducting an inventory of existing unprotected, raised concrete culvert endwalls and headwalls to establish a priority with their highway safety improvement program for their modification in accordance with FHA recommended practices. To the U.S. DOT the NTSB recommended initiating a research program to identify new approaches to reduce the injuries and damages caused by the dangerous behavior of pressurized, liquified flammable gases released from breached tanks on bulk transport vehicles.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594

Rept. No. NTSB-HAR-76-4; 1976; 23p

Availability: NTIS

HS-019 674

HIGHWAY ACCIDENT REPORT. AUTOMOBILE COLLISION WITH AND COLLAPSE OF THE

YADKIN RIVER BRIDGE, NEAR SILOAM, NORTH CAROLINA, FEBRUARY 23, 1975

About 9:25 p.m., an automobile struck a vital structural member of the Yadkin River Bridge near Siloam, N.C. The collision occurred in heavy fog. Following the impact, the bridge collapsed and both the automobile and the bridge fell into the river. Six more vehicles vaulted into the collapse zone within a 17-minute period. Four persons were killed and 16 were injured. Some of the National Transportation Safety Board (NTSB) conclusions are as follows: the driver of the car striking the bridge member lost control of his vehicle for reasons that could not be determined; the timber bridge rails were inadequate to redirect the vehicle or to prevent it from penetrating structural components of the bridge at shallow angles and at speeds under 40 mph; the vehicles that vaulted into the collapse zone were traveling too fast to respond adequately under the existing visual and road surface conditions; the existing condition of the bridge did not contribute to the accident. The NTSB determined that the probable cause of the bridge collapse was the penetration of the timber railing by the vehicle and its subsequent impact with and crushing of a vital structural member of the bridge truss. Five recommendations to the DOT to improve the safety of bridges on public roads are detailed, including: the institution of a program in cooperation with the states to provide for the investigation, by multidisciplinary accident investigation teams, of all bridge collapses on public roadways, and accidents involving vehicles that have struck traffic barrier railings on bridges and damaged structural members vital to the bridge's stability; and performance of a sufficient quantity of skid tests on timber roadway surfaces to establish if such surfaces can normally meet the recommended skid number values contained in the pertinent Highway Safety Program standard.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-76-3: 1976; 32p
Availability: NTIS

HS-019 675

HIGHWAY ACCIDENT REPORT. COLLISION OF WINNEBAGO MOTOR HOME WITH BRIDGE COLUMN, NEAR MONROE, MICHIGAN, JULY 1, 1975

At 10:35 a.m., e.d.t., a Winnebago motor home traveling south on Interstate 75 ran off the highway and crashed near Monroe, Mich. The motor home left the roadway, struck the end section of a guardrail, then struck a concrete bridge column, and caught fire almost immediately. The fire that destroyed the vehicle was fed by two 40-lb propane tanks that became detached from the vehicle. Of the 10 vehicle occupants, the driver and passenger, neither of whom was wearing a seatbelt, were injured when they were ejected through the front of the vehicle. Seven persons perished in the subsequent fire and one was injured but escaped from the vehicle unassisted. The National Transportation Safety Board (NTSB) determines that the probable cause of the accident was the driver's failure to change lanes properly. The failure of the driver and a passenger to use their seatbelts prevented them from remaining in the vehicle where they might have been able to rescue other passengers. The escape of propane from the two disconnected gas tanks added to the intensity of the vehicle fire. As a result of its investigation of this accident, the Safety Board made three recommendations concerning the use of seat belts, motor

home appliances, and propane supply systems. The Standard for Recreational Vehicles should be amended to require some method of assuring that the supply of propane be contained temporarily should the tank valves, regulators, or service lines become damaged. An engineering study should be conducted to determine the best methods of securing appliances in recreational vehicles. A safety campaign should be conducted to emphasize to the occupants of motor homes the benefits of seat belts. Manufacturers of motor homes should be urged to print information in the owner's manual stressing the benefits of seat belts.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-76-2: 1976; 32p
Availability: NTIS

HS-019 676

HIGHWAY ACCIDENT REPORT. COLLISION OF HUBERT ROTEN TRUCKING COMPANY TRUCK AND SKINNER CORPORATION BUS, NEAR HAMILTON, GEORGIA, JUNE 6, 1975

At 6 p.m. a southbound tractor-semitrailer (truck) collided with a northbound intercity-type bus. The bus was the second vehicle of a four-vehicle convoy. Two southbound automobiles were waiting for the convoy to pass before the first could turn left into a driveway. The truck was following the automobiles, and when the truck driver attempted to avoid the cars, his truck jackknifed and collided with the bus. The vehicles collided on a two-lane highway in a sparsely populated, rural area. A light to moderate rain was falling. The truck driver and bus driver were killed in the collision, and 19 of 20 bus passengers were injured. The National Transportation Safety Board (NTSB) determines that the probable cause of this accident was the failure of the truck driver to operate at a proper speed and with a proper level of attention to and concern for safe driving.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-76-5: 1976; 21p
Availability: NTIS

HS-019 677

SHOCK ABSORBERS

A history of the development of shock absorbers points out that "shock absorbers" is actually a misnomer as it is the spring which absorbs shock while the shock absorber's principal function is to damp the suspension movement on upward jounce and resulting rebound. The first primitive shock absorbers were introduced at the dawn of the 20th century along with the development of heavier, faster cars used in racing. By the middle of the teens, suspension damping devices were being incorporated into the design of some large passenger cars. Some of the early devices are described and include the Hartford Swivel Type, the United Helical Spring, the Gabriel Snubber, and the Houdaille Rotary Vane. The twenties saw gradual adoption of shock absorbing units of one type or another. Widespread adoption of independent front suspension in the mid-1930's initially favored the cam-and-lever configuration, and in post-war years the trend was to shock absorbers of telescopic form. By 1949 the all-welded, sealed hydraulic shock absorber was available. By the late 1950's the transition

to telescopic units was complete, and today these components are used in a wide range of damping applications. Design criteria, fluid mechanics, multiple valving, specification and evaluation, heat and aeration, refinements, manufacturing, and marketing are all briefly discussed in relation to the "shock absorber."

by Dennis J. Simanaitis
Publ: Automotive Engineering v84 n11 p34-9 (Nov 1976)
1976
Availability: See publication

HS-019 678

PRECHAMBER DESIGN IMPROVES LEAN DRIVEABILITY

A prechamber has been designed which enhances the lean combustion process. The prechamber relies on the usual intake port and compression stroke for its homogenous charge. The Turbulence Generating Pot (TGP) is designed to increase the rate of flame propagation during lean combustion. In the compression stroke, an increased pressure differential causes fresh mixture to flow into the TGP. The spark plug, located at the TGP/main chamber orifice, ignites the mixture and produces a flame kernel in the TGP-directed mixture flow. Rapid combustion in the prechamber ensues, and a jet of flame streams back into the main chamber. This jet flame promotes turbulence and increases the flame front velocity in the main combustion process, and lean combustion is thereby enhanced. Results from comparison testing show that the TGP concept decreases torque fluctuation, improves brake specific fuel consumption (with lean mixtures), reduces NOx output, lowers CO output, and increases HC output. In addition, the TGP concept along with changes in the exhaust system (portliners cast into exhaust port to reduce heat loss through cylinder head and a thermal reactor fitted for downstream treatment of HC emission) and carburetor (new type of air bleed tube for generating a homogenous lean mixture resulting in better atomization) meets Japan's emission standards and appears to do so with reasonable cost, economy, and driveability.

Publ: Automotive Engineering v84 n11 p44-7 (Nov 1976)
1976; 2refs
Based on SAE-760757 "Development of Toyota Lean Burn Engine," by M. Noguchi, S. Sanda, and N. Nakamura:
presented at the Automobile Engineering and Manufacturing Meeting, 18-22 Oct 1976.
Availability: See publication

HS-019 679

RAILROAD/HIGHWAY ACCIDENT REPORT. COLLISION OF A CROWN-TRYGG CONSTRUCTION COMPANY TRUCK WITH AN AMTRAK PASSENGER TRAIN, ELWOOD, ILLINOIS, NOVEMBER 19, 1975

Amtrak turboliner passenger train No. 301 was struck by a loaded dump truck in Elwood, Ill., at 9:10 a.m. The crossing was unprotected and had limited sight clearance between the road and track. Four cars of the five-car train were derailed and 41 persons were injured. The train was owned by Amtrak and was operated by an Illinois Central Gulf Railroad (ICG) crew over the ICG track. The road was a county highway maintained by the Will County Highway Department. The Na-

stop his vehicle short of the track until it was safe to proceed. Contributing to the accident was the inadequate sight clearance between the road and the track on the approach to the unprotected grade crossing. NTSB found further that additional advance warning devices and a reduced speed limit would decrease the likelihood of conflict at this crossing. Active protection for the crossing should have been installed while the road was being reconstructed and before it was opened. The impact by the truck, in combination with the dumping of large amounts of asphalt on and about the rails, caused the train to derail. High priority should be afforded to improving the safety at grade crossing highway-railroad intersections on all high-speed passenger train corridors. The NTSB recommended the following to the Federal Highway Administration: procedures should be included in the guidebook and training course for highway/railroad engineers to insure that active grade crossing protection devices are operational when ungraded or newly constructed streets or highways are opened; states should be urged and assisted to initiate without delay a comprehensive field review of high-speed passenger train corridors; and a schedule of projects should be established to insure that each grade crossing receives appropriate safety treatment. The NTSB recommended to the Federal Railroad Administration that improvements to the coupler assembly on the French-manufactured turbo trains currently in service be required to minimize the possibility of uncoupling.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-RHR-76-2: 1976; 26p
Availability: NTIS

HS-019 680

HIGHWAY ACCIDENT REPORT. SISKIYOU UNION HIGH SCHOOL DISTRICT SCHOOLBUS/AUTOMOBILE COLLISION AND ROLLOVER, I-5, ASHLAND OREGON, MAY 9, 1975

On May 9, 1975, a 1972 school bus carrying 20 persons crashed through a section of guardrail on the northbound portion of Interstate 5 in Ashland, Ore. The vehicle fell down a steep slope and rolled about its longitudinal axis before it came to rest in an upright position about 213 ft from the edge of the pavement. Except for one sidepost-roof bow connection, the roof separated from the bus body. Nineteen of the 20 occupants were ejected through the gap created by the roof separation. Of the 19 occupants ejected, 3 were killed and 15 were injured. The only occupant who remained in the bus was not injured. The accident analysis indicated the following aspects of driver failure: lack of experience with the type of bus; lack of response to warning grade signs; use of fourth gear and high range, which put undue stress on the bus brake; and on-off brake application, causing loss of air pressure and brake overheating. Other contributing factors included probable brake maladjustment; negating effect on service and parking brakes by thermal expansion of brake drums; and roof failure resulting in ejection of bus occupants, due to rearward load at the windshield top and rearward failure of joints at the sideposts, although the impact load was insufficient to prevent occupant survival. It was further concluded that schoolbus cross-sectional integrity must be assured in rollover environments and that the necessary structural assurance is within current technology and material limits. The analysis in-

uncovered the brake maladjustment of the bus involved in the accident. It was also concluded that the driver of the automobile in the accident was not sufficiently alert to yield right-of-way to the approaching bus. As a result of its investigation, the National Transportation Safety Board (NTSB) recommended to NHTSA that the agency initiate a program of dynamic rollover testing of school buses to develop a performance requirement that will insure reasonable structural integrity in rollover environments. Recommendation was also made to the State of California that it insure the implementation of all the provisions of FMVSS No. 17, Pupil Transportation Safety, especially the provisions concerning the systematic preventive maintenance and semiannual inspection of school buses.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-76-1; 1976; 36p
Availability: NTIS

HS-019 681

HIGHWAY ACCIDENT REPORT. IMMIGRATION AND NATURALIZATION SERVICE MULTIPURPOSE VEHICLE/T.R. PRODUCE COMPANY TRUCK COLLISION, NEAR EL CENTRO, CALIFORNIA, MARCH 8, 1974

A multipurpose vehicle (MPV) collided with a parked tractor-semitrailer. The MPV, operated by the U.S. Immigration and Naturalization Service, was transporting 18 Mexican nationals. The MPV driver and 12 of the nationals received fatal injuries; the six surviving nationals received minor to severe injuries. The conclusions of the analysis indicate that the truck was parked less than half the 30 ft distance from the travel lanes required by FHWA standards for unprotected roadside obstructions and that no warning devices were posted. There were no indications that the MPV had any significant mechanical defects. The MPV driver may have been incapacitated before impact by factors other than carbon monoxide. The driver's medical history indicated the possibility that hypertension or its medication, a liver disorder, or diabetes could have caused loss of consciousness before impact. The driver's health was in fact substandard for Federal Personnel motor vehicle operators as well as for the requirements in the INS manual. It was determined that the accident was not survivable for the MPV driver: that the seating space for the 18 passengers did not meet adequate human factors criteria; that fewer fatalities would have resulted if the passengers had had adequate crash protection; that there is need to conduct crash testing for sideward-sitting occupants in order to develop adequate protection for them; and that the security measures of harring windows and securing doors from the outside could pose a safety hazard. In this case the security measures were not a factor, but consideration needs to be given to safety measures, such as a following escort, in cases where rapid evacuation is critical to survival. This report recommends to the Federal Highway Administration that the wording of the rule for placing warning devices be clarified. It recommends that NHTSA establish guidelines for seat installation for after-market installers and that the Administration conduct the above-mentioned crash tests for sideward-sitting passengers. The Civil Service Commission should review their hiring practices of motor vehicle drivers, and that they consider revision of the transportation of aliens so that help will be available to evacuate the transporting vehicle in an emergency. The report

recommends the Dept. of Justice develop guidelines to promote the last-named recommendation.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-75-6; 1975; 32p
Availability: NTIS

HS-019 682

HIGHWAY ACCIDENT REPORT. FRANCISCO FLORES TRUCK/PICKUP TRUCK WITH CAMPER AND TRAILER COLLISION, U.S. ROUTE 395, BISHOP, CALIFORNIA, JUNE 29, 1974

A tractor-semitrailer, loaded with lumber, experienced loss braking capability while descending Sherwin Pass, a steep long grade located along U.S. Route 395 at 30 mph on June 1974 at 12:50 a.m., P.d.t. The unit suddenly began to accelerate at a point 5 to 5 1/2 mi from a truck parking area where driver had stopped to adjust his brakes. The truck manage remain on the roadway for an additional 2 to 2 1/2 mi, but was attempting to negotiate a curve, the trailer separated from the tractor and overturned in front of a pickup/camper/trailer traveling in the opposite direction. All seven occupants of camper, which burst into flames at impact, died in the accident. The National Transportation Safety Board (NTSB) determined that the probable cause of this accident was loss of braking that permitted the tractor-semitrailer to away. The loss of braking effectiveness was caused by the proper adjustment of the brakes by the driver, the selection too high a gear for descent, and a weight overload of truck. The truck driver could have taken more appropriate emergency actions, but his relative inexperience with respect to driving and emergency actions, the lack of information concerning the character of the roadway ahead, and the lack of an existing escape route served to prevent a more appropriate course of action. The pickup driver had no possibility of avoiding the collision. The NTSB recommends the following: the Federal Highway Administration: develop and disseminate throughout the motor carrier industry an "On Guard" bulletin alerting drivers of commercial vehicles equipped with externally adjustable braking systems of brake adjustment facility, adjustment methods to detect potential problems, scan brake adjustment problem, and methods for proper on-ramp adjustment; determine the critical roadway characteristics formation for safe descent of long/steep highway grades; locate problem areas of signing configurations for long/steep highway grades and obtain information for developing more adequate signing standards for various highway grades; request presentation of critical roadway characteristic information from drivers of commercial or other large vehicles at long/steep grades; provide through a design policy for escape routes along/steep grades when the character of the grade can contribute to runaway.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-75-5; 1975; 33p
Availability: NTIS

HS-019 683

HIGHWAY ACCIDENT REPORT. DEATON COMPANY INCORPORATED, TRUCK/AUTOMOBILE COLLISION,

**CHATTAHOOCHEE RIVER BRIDGE, I-20,
ATLANTA, GEORGIA, AUGUST 21, 1973**

Just before 10:12 a.m., a passenger car and a truck, both west-bound, collided on the Chattahoochee River Bridge in Cobb County, Ga. Traffic was congested and moving slowly in the right westbound lane from the Six Flags Road off-ramp eastward to the vicinity of the Chattahoochee River Bridge. The driver of the car, apparently attempting to avoid the traffic ahead, veered from the right lane to the left westbound lane, where the car was struck by an overtaking truck and pushed 102 ft west of the point of impact and came to rest locked together with the truck. Four of the five occupants of the car were killed, and the other severely injured. The truckdriver was unharmed. The National Transportation Safety Board (NTSB) determined that the probable cause of this accident was the failure of the driver of the car to control her automobile while attempting to avoid unexpected slower moving vehicles ahead. Her failure resulted in an erratic move to the left and into the path of the overtaking truck. Contributing to the accident were unexpected congestion which required a hazardous stop in the right lane, and land-use practices that permitted the generation of traffic in excess of the safe and efficient operating capacity of the roadway. In considering improvements of interchanges at Six Flags Road and at Six Flags Drive, the configuration, message, and location of traffic control devices for both interchanges should be an integral part of the planning and design. The successful operation of both interchanges requires that they function as one integrated system. A comprehensive land-use plan for urban areas of potential areas of urban growth would assure that traffic volumes could be more adequately forecast and the planning of adequate highway facilities would be greatly enhanced. NTSB recommended that the Federal Highway Administration, in cooperation with Housing and Urban Development and the Environmental Protection Agency, conduct research on the interrelationships of land-use planning and highway design and operation, and then implement the findings.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-75-4; 1975; 35p
Availability: NTIS

HS-019 684

**HIGHWAY ACCIDENT REPORT. HOPPY'S OIL
SERVICE, INC., TRUCK OVERTURN AND FIRE,
STATE ROUTE 128, BRAINTREE,
MASSACHUSETTS, OCTOBER 18, 1973**

Because of a left-side tractor-tandem equalizer beam failure, a tractor-semitrailer (tank) carrying gasoline overturned on Massachusetts State Route 128 at 5:30 a.m. At the time of the accident the truck was traveling at 55 mph and the driver had not reduced speed to the posted advisory maximum safe speed of 30 mph. The truck was overweight by 4,535 lbs. After failure of the equalizer beam, the vehicle veered to the right and struck a guardrail that redirected the truck back into the roadway. However, the semitrailer overturned onto the guardrail, which punctured the tank shell and permitted gasoline to escape. The overturned vehicle slid on its side back into the roadway, abrading holes in the tank shell and permitting further escape of gasoline. The gasoline ignited, killing the driver. The National Transportation Safety Board (NTSB) determined that the cause of loss of control and subsequent overturn of the truck was the failure of the rear end of the left

equalizer beam of the tractor tandem suspension. The failure was precipitated by the increased dynamic loading imposed on the equalizer beam as the truck traversed a depression in the road. Contributing to the failure of the equalizer beam were: inappropriate maintenance and repair procedures used to remove worn bushings and sleeves from the beam (a cutting torch had been used to remove worn equalizer beam bushings and sleeves, which produced cavities in the equalizer beam parent material and created stress raisers that reduced the strength of the material); overweight cargo; and the presence of the minor depression in the road. The guardrail design and installation initially performed as desired by redirecting the truck along the guardrail. NTSB made the following recommendations to the Federal Highway Administration. The significance of proper vehicle maintenance and repair procedures should be publicized with particular emphasis on the importance of not using heat in areas that may be adversely affected by heat. Massachusetts should increase enforcement of gross weight regulations in motor vehicles. Present regulations should be surveyed for the intention to provide protection against puncture or abrasion of cargo tank walls during predictable accident environments and if not, rewrite the regulations. Maintenance and repair manuals should delete any reference to the use of heat-producing methods to maintain or repair parts that may be adversely affected by such methods. These manuals warn against such use. Additional information presented in appendixes includes metallurgical laboratory reports associated with the accident, excerpts from the Motor Trend Truck Service Manual concerning the equalizing beam suspension, service instructions for Hendrickson tandem axle units, a summary of a similar accident, and a letter from NTSB to the Administrator of the Federal Highway Administration concerning the danger in the maintenance operation described.

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C. 20594
Rept. No. NTSB-HAR-74-4; 1974; 44p
Availability: NTIS

HS-019 688

FUEL INJECTION FOR ALL

Because the carburetor is not a sufficiently high-precision instrument with regard to mixture control, it will probably be replaced by fuel injection engines, already in common use (especially in Europe where one-third of all cars have some form of fuel injection system). Benefits derived from the fuel injection system include: better starting and lower fuel consumption; no need for manifold heating and cooler intake air assuring better cylinder filling; elimination of vapor lock, throttle valve icing and ill effects from carburetor heating; greater advancement of the spark; a shorter warm-up period; uniform air/fuel ratios in all cylinders; lowering of unburned hydrocarbon (HC) emissions; and an ability to run on leaner mixtures which reduces carbon monoxide (CO) emissions. Experimentation on fuel injection began in 1863 and is still going on. Whereas early injection systems are mechanical and electrical, present systems operate, for the most part, electronically. An electronic injection system has the following advantages: fewer moving parts, no ultra-precision machining standards, quieter running, lower power loss (no electrical requirements), no need for special pumpdrives, no critical fuel filtration requirement, no surge or pulsations in the fuel line, and low cost. Much of the development over the years has been done in Europe by Bosch, Mercedes-Benz, Ferrari,

Maserate, Jaguar and Alfa Romeo. In the U.S. development began in Indianapolis and has been continued by private inventors and large companies such as Chevrolet and Ford. The report gives a detailed history of injection systems. Currently, three fuel injection systems are used most widely: The D-Jetronic, the Bosch L-Jetronic, and the Bosch K-Jetronic, the latter two of which are part of the new generation of "smart" fuel injection systems that measure air mass. The D-Jetronic calculates fuel quantity on the basis of manifold pressure and rpm. Injection is timed to coincide with inlet valve opening for half of the cylinders, but for the others, injection occurs with closed valves, so that the fuel must be stored in the port area till the valves open. The Bosch L-Jetronic injection is an electronic system working with a low-pressure electric pump. It has proved highly accurate for measuring mass flow but has a weakness in its relative lack of ability to compensate for changes in density. This involves a risk in running rich with high under-hood temperatures and at high altitude. The K-Jetronic is a mechanical system in which fuel delivery is controlled by a gas flow meter. The accelerator pedal is linked to a throttle valve that controls the air volume admitted. For the future, a mechanical counterpart to the K-Jetronic is being developed by Deutsch Vergasergesellschaft, and Zenith has developed the low cost new CI. version with continuous injection and air mass measurements, whose potential lies in wide use in mass-produced cars.

by Jan P. Norbye

Publ: Road and Track v28 n3 p68-72 (Nov 1976)
1976

Availability: See publication

HS-019 689

UNBUCKLING THE SEAT BELT MYSTERY

Answers to questions often asked about motor vehicle safety restraints are presented. The difference between passive and active restraint systems is explained (a passive system does not have to be buckled, adjusted or otherwise handled, for example air bags). There are presently two sensitivity-triggered devices in the seat belt mechanism which cause the belt to lock up in a crash (a belt-sensitivity reel device triggered by the centrifugal force resulting from the acceleration of the belt as it is played out from the reel; a second device working basically on the same principle but triggered by car's rate of deceleration). Rigorous testing is made of seatbelt webbing for durability and cycle life, and of the buckle, its metal tongue, and the mounting brackets and bolts for tensile pull strength. Common excuses for not wearing seat belts include fear of being trapped in a burning or submerged car, belief that getting away from the car is better than staying with it, inconvenience of buckling up, and confidence in ability to avoid accidents. Responses to such excuses include the facts that less than 0.5% of accidents involve fire or submersion, and that 47% of all traffic deaths occur specifically because the victim was thrown from the car (or through it).

by Dennis J. Halladay

Publ: Driver v10 n5 p12-7 (Oct 1976)
1976

Availability: See publication

HS-019 690

WINTER DRIVING

Tips on winter driving begin with care of the car. For better starts get a tune up, new plugs and new points. Clean the battery terminals and cables with a wire brush, and add distilled water to low battery cells. Put antifreeze in the radiator at a ratio of 50% water, 50% antifreeze; once a year. To avoid exhaust gases entering the car, check the exhaust system for rusty, cracking tailpipes and muffler, and drive with windows down about 1 inch for ventilation. Get a lubrication job. Change the oil in accord with the temperature zone you live in. Check the brakes and get the wheels aligned. Keep windshields completely free of ice and snow. Make sure wipers and lights are working properly. Tips for driving on ice include smooth starts, low speeds, easy moves, and stopping when good sense demands it. Watch out for "black ice" on bridges, underpasses, and shaded portions of highways. Rules for skidding include: calmly and slowly removing foot from gas pedal, braking with slow, light pumping, keeping car in gear, turning wheel in direction the rear wheels are moving, and straightening out the wheel and rolling for a short distance after coming out of the skid and before accelerating. Front wheel drive (FWD) vehicles require slightly different skidding procedures because they are engine-braked in the front: don't decelerate; if possible, speed up slightly while turning wheel in the direction of the slide. Warm up the engine rather than drive while it is cold. Regarding tires: reinforced chains are best, and in descending order of effectiveness, studded snow tires, snow tires, radials, and regular cord tires. Deflating tires serves no purpose. For FWD cars, snow tires or chains go on front. Finally, carry emergency equipment: sand, shovel, traction mats, and chains.

Publ: Driver v10 n5 p1-7 (Oct 1976)
1976

Availability: See publication

HS-019 691

BEHAVIORAL ENHANCEMENT. FINAL REPORT. 0DRUGS EFFECTS ON DRIVERS0

A review of completed and ongoing research on the behavioral effects of drugs on drivers is presented. Phase one of this project involved extensions of work initiated on Contract Nonr-4423(00) and included an analysis and reporting of recent experimental data and preparation of a revised version to reach the less specialized audience of a journal article. (A list of publications based on data from the initial contract is given.) While Phase two (study of the possibility of conditioning drug-induced effects for operant control) preparation was underway, it was possible to build upon concepts developed in the earlier work applicable to the amelioration of drug impairment in everyday activities, principally the effects of beverage alcohol on automobile operation. Recent developments along these lines are described. Research on speed stress and information transfer under short-term storage requirements shows that extensive practice reduces the time required to respond accurately to a set of stimulus elements; the more complex the stimuli, the smaller the reduction. Research on the performance enhancement from single amphetamine doses (without a reversal) shows that subsequent rebound is either slight or nonexistent. Studies of drug effects on complex decision making show that no significant drug effects are found on bidding accuracy; alcohol produces significant effects on eight mood clusters (while methylphenidate produced little), and

April 30, 1977

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verbal production was increased by methylphenidate but not by alcohol. With respect to drug guessing by volunteers in experimental tests, little error should be expected to arise from application of the usual placebo controls. Few firm conclusions have been drawn from studies on alcohol and accidents, but results show that the role of self-reported drinking habits is considered as a moderator of hazard-BAC relationships and of enforcement implications. Preparation for Phase two (drug conditioning-biofeedback experiments) is described in terms of objectives, literature review, and apparatus.

by Paul M. Hurst
Institute for Res., Div. of Psychobiology, 257 Pugh St., State College, Pa. 16801
Contract N00014-71-C-0219
Rept. No. AD-758 411; 1973; 16p 8refs
Rept. for 1 Mar 1971-28 Feb 1973.
Availability: NTIS

HS-019 692

ON THE KINEMATICS OF THE HEAD USING LINEAR ACCELERATION MEASUREMENTS

An application of the nine accelerometer scheme proposed by Padgaonkar et al. (1975) to the analysis of head kinematics including head angular acceleration and velocity using linear acceleration measurements is presented. The computed results have been compared with film analysis and with actual measured quantities in the case of dummy experiments, and an excellent agreement among these results indicates the feasibility of the application of the method to biomechanical studies.

by C. C. Chou; S. C. Sinha
Publ: Journal of Biomechanics v9 n10 p607-13 (1976)
1976; 9refs
Availability: See publication

HS-019 693

THE NOISE AND TRACTION CHARACTERISTICS OF BIAS PLY TRUCK TIRES. VOL. 1 NOISE AND DRY TRACTION FINDINGS

A data base of noise and traction characteristics for a sample of bias-ply heavy truck tires has been established. The tire sample, representing both rib and lug type tread patterns, was tested according to the SAE J-57 tire noise procedure and showed that lug type tires are noisier at peak levels than rib-type tires. A third-octave analysis of the noise spectrum for each tire in the sample was also obtained. Dry-pavement traction test of the tires was conducted using a flat bed tester which measures the cornering stiffness parameter defined as the slope of the side force versus slip angle relationship through the origin and using two mobile traction dynamometers, one which measures longitudinal traction, a tires longitudinal force response to longitudinal slip, and one which measures the lateral traction, the relationship between side forces and slip angle, but on real pavement at actual highway speeds. These traction tests showed that the noisier lug-type tires exhibit traction properties which are generally less desirable

from the viewpoint of their influence on vehicle response to steering and braking.

by Robert D. Ervin; Robert E. Wild
University of Michigan, Hwy. Safety Res. Inst., Huron Parkway and Baxter Road, Ann Arbor, Mich. 48109
Grant MVMA-361048
Rept. No. UM-HSR1-76-2-1; 1976; 153p
Sponsored by Motor Vehicle Manufacturers Association. Vol. 2 is HS-019 694.
Availability: Motor Vehicle Manufacturers Association, 320 New Center Building, Detroit, Mich. 48202

HS-019 694

THE NOISE AND TRACTION CHARACTERISTICS OF BIAS-PLY TRUCK TIRES. VOL. 2 WET TRACTION FINDINGS

Wet traction data for a tire sample representing both rib and lug type tread patterns were obtained. Both longitudinal traction properties, a tire's longitudinal force response to longitudinal slip, and lateral traction properties, the relationship between side forces and slip angle, were investigated, and the load sensitivity of and effect of velocity on these traction properties were measured. Previous traction tests on dry pavement had demonstrated that the lug-type tires exhibit traction properties which are generally less desirable from the viewpoint of their influence on vehicle response to steering and braking. These tests show that the differences in braking traction between lug and rib type tires are even more pronounced on wet surfaces.

by Robert D. Ervin; Charles C. MacAdam
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Grant MVMA-361048
Rept. No. UM-HSR1-76-2-1; 1976; 43p
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HS-019 695

MOTORIST AID SYSTEMS STUDY. FINAL POLICY REPORT

Motorist Aid Systems (MAS) must provide the following services: detection-awareness that a motorist at a certain location needs help; definition-identification of the type of assistance needed; dispatch-sending the appropriate service vehicle; service-providing the assistance needed; and recording-documenting the occurrence. Present FHWA policy is basically sound and should continue to support the installation of roadside callbox systems. FHWA should concentrate its near-term efforts on improving and expanding roadside installations and on coordinating its research efforts with parallel studies. FHWA should continue as a general funding policy to assure that the system selection process considers not only initial capital cost, but maintenance and operating cost over a predicted service life. Long-term expandability and capability should also weigh heavily in determining system design. More emphasis should be placed on system functional capabilities, such as, alarm, equipment component detail. FHWA should

Consideration should be given to emphasizing the development of system objectives in the design phase as a Federal requirement, including the definition of objectives and illustrative examples. The evaluation requirements should be reassessed to determine if they are still reasonable and necessary. Stopped vehicle studies as presently structured appear redundant. The definition of response time should be revised to read "... from time of call for assistance until the appropriate response vehicle arrives." The requirement for benefit-cost ratios as a measure of system effectiveness should be deemphasized. Many specific items of required data are not reported because of the difficulties (time, cost, staff capabilities) in obtaining the necessary input; these should be weighed against their importance to FHWA. The requirement for data considered crucial should be enforced. FHWA should consider providing additional guidance and assistance to states in developing operational plans. More emphasis should be placed on increasing public awareness of operational motorist aid systems through media participation and public education techniques. More study is needed to assess the cost effectiveness of the call confirm and call cancel requirement for coded systems. Standardization of the wording used in MAS highway signs should be required. Isolated rural freeway systems with terminals spaced more than three or more miles apart should be encouraged to install signs in between callboxes. The orientation of the callbox with the roadway should remain flexible and the preferred installation under a variety of conditions should be provided. Inbox illumination for coded systems should be encouraged. The phrase "... when ambient light is not sufficient for operation" should be more precisely defined. Projects should be encouraged to specify a remote checkout capability. The self-interrogation feature on radio-voice systems should be evaluated. FHWA should continue to upgrade the coordination and working relationship between state project engineers and Division office staffs. At the Headquarters level, the competitive environment and a fair and equitable opportunity to all qualified bidders should be maintained.

by J. H. Kell; I. J. Fullerton
JHK and Associates, 275 Fifth St., San Francisco, Calif.
Contract DOT-FH-11-8745
1976: 208p 48refs
Rept. for May 1975-Feb 1976.
Availability: NTIS

HS-019 697

DRIVING FOR THE ELDERLY

Visual and other factors affecting driving ability, with particular emphasis on elderly drivers, are discussed. The visual factors taken into consideration include visual acuity, muscle balance, field of vision, dark adaptation, glare effects, and color vision. Defects in field of vision include central scotoma, hemianopia, tube vision, and monocularly. Adaptation to dark is a process of switching from cone vision to rod vision, which may be hindered by glaucoma, certain retinal diseases, and vitamin deficiency. General factors include temperament, reaction time, driving experience, traffic conditions, and journey time. It is suggested that administration of tests to elderly people that cover these factors should allow more pertinent and fairer certification for elderly drivers, at least so far as the important visual factors are concerned, and may give a lead to

the approach of the others such as hearing, balance, and muscle power.

by W. O. G. Taylor
Publ: Practitioner v213 n1275 p355-60 (Sep 1974)
1974: 6refs
Availability: See publication

HS-019 698

TRAFFIC VIOLATION FREQUENCIES OF STATE HOSPITAL PSYCHIATRIC PATIENTS

The driving records of 50 previously hospitalized psychiatric aftercare patients, 50 psychiatric outpatients who had never been hospitalized previously, and 50 employees of Northville State Hospital (Michigan) were analyzed for occurrence of traffic violations. All persons in the study were of the same race and socioeconomic status with equal numbers of men and women in each group, and none of the patients had serious physical disorders, were addicted to alcohol or other drugs, or had antisocial and sociopathic personality disorders. It was found that men had significantly more violations than women, and men in the patient groups had significantly more violations than men in the employee group. Among women, the importance of the number of violations was not clear due to the small number of overall violations. In the patient groups, those suffering from neurotic disorders had significantly more violations than those suffering from psychotic disorders. It may be inferred from these findings that taking away driver licenses from mental patients is unjustified as a matter of routine practice. Perhaps mental patients (especially those with high violation frequencies) should be required to receive retraining in driving and be evaluated at frequent intervals for their skill and fitness.

by K. L. Ramadas
Publ: American Journal of Orthopsychiatry v45 n5 p887-9 (Oct 1975)
1975: 16refs
Availability: See publication

HS-019 699

A CRITICAL ANALYSIS OF PELTZMAN'S "THE EFFECTS OF AUTOMOBILE SAFETY REGULATION"

Seat belt installations first required by State laws and Federal motor vehicle safety standards have reduced car occupant deaths substantially. But whereas Peltzman reports that the effects of these regulations on occupant fatalities were offset by increased nonoccupant deaths, this report shows that by examining the assumptions, model, and data, Peltzman's conclusions are not warranted. Peltzman's multiple regression model, used to project post-regulation expected fatality rates, employs variables that are correlated in such a way that distortion in the projections is guaranteed. The "crash cost index" should be dropped from the model both because of the severe change in pre- and post-projection correlations with other variables, and because of its highly questionable reflection of crash costs, e.g., components of the Consumer Price Index of auto repair services do not reflect the costs for the types of property damage that occur in crashes. Peltzman used the ratio of 15-24 year olds in the population to those older as a proxy measure of youth involvement in crashes. However, the percent-

but the earliest years. Peltzman treated pedestrian deaths, bicyclist deaths, and motorcyclist deaths as a homogeneous group; but motorcyclists are often killed in crashes where no other vehicles are involved and when in a crash with a car, the motorcyclist suffers greater damage than would a pedestrian. Therefore motorcyclists contribute excessively to the death rate. Peltzman used apparent consumption of only distilled spirits as his alcohol measure, ignoring the large consumption of beer. Finally, Peltzman did not take into account the substantial proportion of deaths to vehicle occupants and nonoccupants alike which occur in or because of trucks, which were not affected by many of the State belt installation laws and most of the Federal safety standards. A modified regression model is presented that compensates for the Peltzman weaknesses. The modified model produced projected fatality rates substantially above the actual rates in the 1960's and early 1970's consistent with the hypothesis that regulation reduced fatalities. Data from other studies also support that hypothesis and there is no evidence of increased "risky driving" in regulated vehicles.

by Leon S. Robertson
Insurance Inst. for Hwy. Safety
1976; 14p 18refs
Rev. Jun 1976. To be published in Journal of Economic Issues.
Peltzman's rept. is HS-016 511.
Availability: Corporate author

HS-019 700

LIFE EVENTS, SUBJECTIVE STRESS, AND TRAFFIC ACCIDENTS

In an effort to better assess individual accident risk and to provide more rational traffic safety programs, a survey was conducted to evaluate the relationship between transitory life changes and subjective stress, and traffic accidents. A total of 532 male drivers over the age of 20 responded to a self-administered questionnaire which focused on the type and number of life changes and the resultant adjustment required of the drivers during the previous 12 months. To assess life changes a modified version of Holmes and Rahe's Life Events Checklist was utilized, but a new scoring system was used based on the subject's own estimate of the adjustment required of him by each life event. Also included were a variety of questions to measure physical stress responses and subjective stress emanating from many life contexts including marital and family life, working conditions, financial status, and health concerns. Two questions centered on distress caused by broad social and ecological issues, and several questions related to aggression, paranoid thinking, depression, and suicidal tendencies. Alcohol abuse was also assessed. Results of the study show that life change and subjective stress are significantly related to traffic accidents, and these factors appear to be statistically more important than demographic, personality, and social maladjustment variables that have previously been the focus of behavioral scientists. The need for additional research in this area is emphasized.

by Melvin L. Selzer; Amiram Vinokur
Publ: American Journal of Psychiatry v131 n8 p903-6 (Aug 1974)

1974; 20refs
Revised version of a paper presented at the 126th Annual Meeting of the American Psychiatric Assoc., Honolulu, 7-11

HS-019 701

INJURY IN AGED, CLINICAL, AND EPIDEMIOLOGICAL IMPLICATIONS

The three types of events which account for about three quarters of all injury deaths among the elderly are falls, fires and contact with hot substances, and vehicular collisions. Results and a discussion are given of a study comparing 150 randomly selected persons age sixty or older who have been seen in an emergency room of a hospital after a fall and the same number of persons of similar age and sex who live near the injured person but who have not been seen for an injury. Tables give information on mechanisms of falls according to recent alcohol use and precipitating health problem, product involvement in falls according to presence of precipitating health problem, and observed lucidity and reported physical limitations according to presence of precipitating health problem. Current data tentatively support the conclusion that brittleness of bone, small muscle mass, or both are substantial contributors to fractures in the elderly, and that the nature of the surface struck is less important, but not entirely irrelevant, in determining the severity of injury of persons who fall in this age range. In regard to fires and contact with hot substances, it is emphasized that major attention must be given to environmental aspects of control (e.g. electric stoves which may continue to be dangerously hot after it has ceased to glow). With regard to vehicular crashes, data show that healthy older drivers do not have an appreciable increase in crash risk over that of middle-aged drivers, but that such an increase is associated with medical impairment. Consideration should be given to identification and regulation of high-risk elderly drivers, starting with the periodic relicensing process and then identification of individuals between license renewals. The greatest emphasis in prevention and mitigation of injury in the aged must be on use of environmental controls rather than on attempts to change or restrain a segment of the population whose capabilities often are decreasing in ways and at rates that are both unpredictable and uncontrollable.

by Julian A. Waller
Publ: New York State Journal of Medicine v74 n12 p2200-8 (Nov 1974)
1974; 25refs
Presented at Judith and Herbert Seltzer Award Lecture and Symposium on Accidents in the Aged, New York, 14 May 1974. One in a series of articles dealing with problems in aging.
Availability: See publication

HS-019 702

TIME-SHARED MULTIPLEXING SYSTEM APPLIED TO MOTOR VEHICLES

From evaluation of the various systems (electromechanical latching, digital system, frequency selective systems, tone code systems), it appears that the time-shared multiplexing system has advantages in application to vehicles with complex or highly variable electrical installations. Disregarding the simple electromechanical systems, digital, frequency selective and tone code systems all have drawbacks of being affected to some degree by temperature variation or spurious interference signals. It is suggested that the time-shared multiplexing system minimizes these to a level that renders them of little significance, with the additional recommendation that the

evidence suggests that the time-shared multiplexing system will compare favorably with other proposals.

by L. J. Nevett
Lucas Electrical, Ltd., United Kingdom
Rept. No. SAF-760181; 1976; 12p
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAF.

HS-019 703

THE CORRECTIVE THERAPIST AND THE HANDICAPPED DRIVER

The basic design types of adaptive automotive controls for the handicapped driver include: push-pull control (push forward for braking, pull for acceleration), push-right-angle-pull control (push forward for braking, pull perpendicularly downward for acceleration), push-twist control (push for braking, twisting hand grip about X axis for acceleration); crank-type control (motion about X axis in one direction for braking, in opposite direction for acceleration). The critical design features, common faults in construction and fabrication, and frequently undervalued or neglected factors of installation and inspection are considered. Three basic safety principles related to system design were evolved from a study of a variety of systems and are as follows: acceleration should never be actuated by the push motion, forces in the hand-control system must be balanced so that neither the brake nor accelerator is actuated in hands-off position, and the mode of operation should require distinctly different motions for acceleration and braking. Of 17 systems studied, only five were found to be safe for road testing by handicapped drivers. It is emphasized that extreme caution must be exercised to assure quality installation, and continued safe operation of a system will depend on the quality of the inspection and repair service.

by Charles C. Freeman
Publ: American Corrective Therapy Journal v29 n4 p138-42
(Jul-Aug 1975)
1975; 3refs
Availability: See publication

HS-019 704

EFFECT OF TWO WEEKS' TREATMENT WITH CHLORDIAZEPOXIDE OR FLUPENTHIXOLE, ALONE OR IN COMBINATION WITH ALCOHOL, ON PSYCHOMOTOR SKILLS RELATED TO DRIVING

An investigation of the subacute effects of chlordiazepoxide and flupenthixole, anti-anxiety drugs used in the treatment of neurosis, on psychomotor skills related to driving was conducted. Twenty healthy male students aged 20 to 23 years received two weeks' treatment with chlordiazepoxide 10 mg t.i.d. or flupenthixole 0.5 mg t.i.d. The tests used were a choice reaction, two coordination and an attention test having correlation with traffic behavior. Neither of the drugs impaired psychomotor performance on the 7th or 14th days of the experiment. The combination of either drug with 0.5 g/kg. of alcohol impaired coordination and attention to an extent which can be considered dangerous for traffic and occupational life. Their interaction with alcohol was not so strong as that between diazepam and alcohol. The combination of chlor-

diazepoxide with alcohol tended to increase the anxiety or normal subjects.

by M. Linnoila; I. Saario; J. Olkonen; R. Liljequist; J. J. Himberg; M. Maeki
Publ: Arzneimittel-Forschung v25 n7 p1088-92 (Jul 1975)
1975; 15refs
Includes German summary.
Availability: See publication

HS-019 705

A STUDY OF IDAHO MOTORCYCLISTS INJURED IN 1974 ACCIDENTS

A survey of Idaho motorcyclists who had experienced a motorcycle injury accident in the state during 1974 was conducted in order to determine opinions on the value of helmets, the mandatory helmet law, and other related matters. Response was 193 out of a total of 562 persons to whom a questionnaire was mailed. There were 7.67 motorcyclists strongly in support of the law for every one strongly opposed. Of motorcyclists who commented on the law, 77.3% were in favor. Of motorcyclists who wore helmets, 84.7% indicated that the helmet reduced injury and 8.7% voluntarily added that it saved their lives. Neck injuries were very rarely incapacitating. Over half of the respondents were at least 20, and those over 35 comprised 20.7% of the respondents. Over 75% of the motorcyclists had more than one year of motorcycling experience. It was found that injury severity codes marked by investigation officers are accurate indications of injury severity. The survey was favorable toward motorcycle training courses and motorcycle licensing with written and traffic exams (except off-road driving exams), and supported the importance of eye protection (but against eye protection laws). Single motorcycle accidents occurred mainly in rural areas during daylight hours while those involving a car or truck occurred mostly in urban areas. Over half of the incapacitating injury accidents occurred in rural areas while non-incapacitating injury and noninjury accidents occurred mostly in urban areas. Automobile driver awareness of and courtesy toward motorcyclists was determined to be the primary single factor in motorcycle collisions. Recommendations include needs for an eye protection study, a count of motorcycles without rear view mirrors, surveys, a national study on alternate methods of measuring vehicle miles and accident and injury denominators for comparison, and a public information program to stress motorcyclist visibility and driver awareness of motorcyclist rights and problems.

Idaho Traffic Safety Commission, Statehouse, Boise, Idaho
83720
1976; 19p 5refs
Availability: Corporate author

HS-019 706

RUBBER USE IN 1977 AUTOS

Some new rubber and soft plastic materials are making it in production for the first time, or for the first time with specific automobile manufacturer. Other gains for rubber are apparent in the efforts of design engineers to further improve the ride qualities of the smaller cars, with rubber being used to a greater degree. Automakers continue to experiment with no kinds and applications of rubber (or rubberlike plastics) and phase them into production in place of steel for better durability.

ty and for lightness. More complex emission control systems and more sophisticated electrical systems require more rubber tubing. Higher under-hood temperatures are calling for more rubber and more costly heat-resistant rubber, as are "hotter" ignition systems. The biggest factor in auto industry rubber consumption, near-term, appears to be the number of vehicles built since so many things tend to cancel out the impact of car down-sizing. Materials such as carboxylic nitrile rubber, RTV silicone rubber, EPDM rubber, thermoplastic olefin (TPO), Kevlar, and RIM (reaction injection molding) material are used in the construction of the various parts of the automobile. Specific uses of new materials as employed by Chrysler, Ford, American Motors, and General Motors are given.

by Anthony Grey
Publ: Rubber Age v108 n10 p25-34 (Oct 1976)
1976

Availability: See publication

HS-019 707

FORMABLE HIGH STRENGTH SHEET STEELS

New metallurgical practices provide improved strength-to-weight ratios which may extend steel's preeminence in basic automotive sheet metal structure. A promising group of continuously developing materials is the improved high strength low alloy (HSLA) steels, SAE 945--SAE 980, which have yield strengths in the range of 50-80 ksi. The higher strengths of these particular HSLA steels are achieved by a controlled hot rolling schedule and rapid cooling which produces a very fine grain size. Additional strength may be imparted through solution and precipitation hardening by minor additions of V, Ti, and Nb which are good carbide and nitride stabilizers, as well as by nitrogenizing. Several heats of HSLA steels strengthened by the addition of about 0.1% titanium or vanadium were studied. In addition, sheets of three commercial low carbon steels (SAE 1010, SAE 1010 nitrogenized, SAE 945X) were given thermomechanical treatment (TMT). Preliminary results show that the formability of 980X steel can be vastly improved by normalized annealing both hot and cold rolled materials, and suggest that it is possible to produce a new, unique product. This steel, called GM 980X, appears to offer a better combination of mechanical properties than either 950X or 980X steels. It should allow new weight savings applications, and it should also extend the use of these materials to thin sheet applications. V-980X steel appears to be best suited for producing GM 980X by continuous annealing. TMT of the three low carbon steels produce minimum strengths of 58, 80, and 94 ksi in stampings after ambient or elevated temperature aging. Press formability, fatigue, low temperature impact, and corrosion resistance are generally equivalent to commercial HSLA steels of comparable strength. The treatment is equally effective in strengthening both hot and cold rolled steels. Because 80 ksi HSLA steels are hot rolled and thus limited to a minimum thickness of about 0.075 inch, the greatest potential for TMT may be for producing thin gauge cold rolled steel with strengths of 80 ksi or greater.

Publ: Automotive Engineering v84 n11 p49-54 (Nov 1976)
1976

Based on SAE-760206 "GM 980X--A Unique High Strength Sheet Steel with Superior Formability," by M. S. Rashid (presented at the Automotive Engineering Congress and Exposition, Detroit, Dec 22-27, 1976), SAE-760715, "A

HS-019 708

ON-BOARD COMPUTER TESTING OVER-THE-ROAD TESTS

An on-board computerized data acquisition system carried in a vehicle during over-the-road tests can maintain accurate test records, detect transients, and track incipient failures. In addition, the computer can produce output signals to control vehicle operation or regulate desired variables to achieve repeatable test conditions. This type of system makes it possible to consolidate the three traditional testing phases (laboratory tests, track testing, fleet testing) into a single analytical over-the-road program. Essential components of the mobile data acquisition system include signal conditioners, analog-to-digital converter, microcomputer, digital tape recorder, and static inverter for electrical power. Software development is a continuing operation. Programs are written in assembly language, to minimize core storage and maximize speed. The programs are maintained on punched tape and are loaded into the computer prior to each test through a standard terminal. The major applications of the system to date have involved use of the computer to control the acquisition and storage of data from the transducers. One important application has been in obtaining stress profiles. Currently data acquisition and reduction techniques for tire stability tests are being developed. Programs are written as needed for the computer to perform real-time processing during tests.

Publ: Automotive Engineering v84 n11 p30-3 (Nov 1976)
1976

Based on "Computer Puts a Test Lab on the Road," by L. H. Mull and T. H. Pratt, Allegany Ballistics Lab., Hercules, Inc. Availability: See publication

HS-019 709

TAKING A SOUND APPROACH TO TRANSPORTATION SAFETY. A SUGGESTION FOR REDUCING ACCIDENTS OUTSIDE THE SCHOOL BUS

An approach to reducing accidents involving children outside the school bus, when they are crossing streets or highways, involves use of a public address system called Mobilpage having both inside speakers and an outside horn. The bus driver can speak directly to children inside the bus, giving them last-minute warnings prior to their alighting, and more importantly, he/she continues to exercise effective voice control over them after their leaving the vehicle, with specific voice instructions when to cross and when not to cross the street or highway. He/she can take instant, split-second action in the event of an emergency, action that can save lives by specific voice commands that penetrate highway noise. Driver hand signals or lights are not effective in reducing accidents outside the school bus. What is needed are public address systems specifically designed for school bus operation. Hundreds of school districts have found these safety sound systems to be the most important element in their safety program. Three basic sound systems have been developed. One system permits the driver to make announcements to passengers either inside the vehicle or to those who have left the bus through public address facilities. Another system permits the driver to talk to students on the bus through inside speakers and to students when they

both high-powered radio reception and public address facilities, both inside and out.

Publ: School Bus Fleet v21 n5 p16-7 (Oct-Nov 1976)
1976
Availability: See publication

HS-019 710

BEFORE AND AFTER COMPARISONS OF THE INTRODUCTION OF SUNDAY SESSIONS IN THE PERTH METROPOLITAN AREA FROM THE VIEWPOINT OF TRAFFIC SAFETY

Comparisons were made of the number of persons killed and number of persons injured in traffic accidents in the three years before and after the introduction of Sunday sessions (legalization of sale and supply of liquor during two two-hour sessions on Sundays) in the Perth metropolitan area of Western Australia. A statistically significant increase of persons killed and injured in traffic accidents occurred on Sundays over the other days of the week. For the rest of the State (where the Sunday sessions were not implemented) no such change was evident. It was concluded that the results of the study were consistent with, but did not actually prove, the hypothesis that the introduction of Sunday sessions in the Perth metropolitan area had a detrimental effect on traffic safety.

by D. I. Smith
Road Traffic Authority, Res. and Statistics Div., 22 Mount St., Perth 6000, Western Australia
Rept. No. 6; 1976; 9p 2refs
Availability: Corporate author

HS-019 711

THE RESULTS OF THE CUMBERLAND/YORK (MAINE) ASAP (ALCOHOL SAFETY ACTION PROJECT) REHABILITATION COUNTERMEASURES IN TERMS OF ARREST OF 1142 DRINKER DRIVERS CONTACTED BY REHABILITATION FROM JANUARY 1, 1972 TO DECEMBER 31, 1974

The results of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP) rehabilitation programs in terms of arrest of 1142 drinker drivers contacted by rehabilitation from 1 Jan 1972 to 31 Dec 1974 are presented. Countermeasures of the ASAP were ultimately aimed at the rehabilitation of the problem drinker driver and not merely at restriction or revocation of driving privileges. Information was submitted by ASAP rehabilitation workers to evaluation on 1142 contacts with OUI (Operation Under the Influence) offenders. Entry into treatment resulted from 679 (59.46%) of the contacts. Of that number, 77 (11.34%) were Unclassified Drinkers while 602 (88.56%) were Problem Drinkers. Unclassified Drinkers received only a course at the Alcohol Safety Action Driving School (ASADS) while Problem Drinkers received a wide variety of traditional treatment procedures for alcoholism and, in 213 (34.37%) cases, the ASADS. Analysis of OUI recidivism showed Unclassified Drinkers with satisfactory completion of ASADS to have the same rate as the untreated population. Unclassified Drinkers with unsatisfactory completion of ASADS and Problem Drinkers regardless of treatment modality show significantly higher recidivism rates than untreated

groups. The length of the interval between recidivism arrests was the same in both treated and untreated groups.

by Ross St. Germain
Social Systems Res. Corp., Bangor, Maine
1975; 36p 4refs
An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.
Availability: Reference copy only

HS-019 712

THE RESULTS OF THE CUMBERLAND/YORK (MAINE) ASAP (ALCOHOL SAFETY ACTION PROJECT) REHABILITATION COUNTERMEASURES IN TERMS OF ARREST AND CRASH RECIDIVISM OF 833 DRINKER DRIVERS CONTACTED AND/OR TREATED IN 1973

The Cumberland/York (Maine) Alcohol Safety Action Project (ASAP) rehabilitation programs in terms of arrest and crash recidivism of 833 drinker drivers contacted and/or treated in 1973 were ultimately aimed at the rehabilitation of the problem drinker driver and not merely at restriction or revocation of driving privileges. Results of countermeasures showed no change in treatment versus no treatment arrest recidivism. With treatment subgrouped into modalities, no differences were found between those who had participated only in the Alcohol Safety Action Driving School (ASADS) and those who participated in the traditional treatment procedures for alcoholism, or between each of those two modalities and no treatment groups. Participants in both ASADS and traditional treatment were found to have significantly higher arrest recidivism rates than both ASADS and traditional treatment and the no treatment groups. This result was explained as a function of an over-representation of the age groups containing an over representation of recidivists, and the failure of treatment to modify the pattern of behavior, rather than an increase in recidivism attributable to treatment. Crash recidivism data were too few to be tested statistically. It was recommended that in the event of extension of the life of the Project, the client selection procedure be modified to more appropriately reflect the characteristics of the hard core problem drinker and alcoholic. Since ASADS has not yet been determined effective in reducing recidivism, it was suggested that its implementation on a statewide basis is premature and it should be put on a trial basis with adequate evaluation before it is institutionally adopted.

by Ross St. Germain
Social Systems Res. Corp., Bangor, Maine
1974; 55p 4refs
An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.
Availability: Reference copy only

HS-019 713

MAINE ASAP (ALCOHOL SAFETY ACTION PROJECT): YORK AND CUMBERLAND COUNTIES. KEY ANALYTIC STUDY. AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES

An analysis of ultimate performance measures of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver, discusses only comparisons between

control and experimental counties with no clear knowledge that significant differences or nondifferences may be a result of change in the ASAP program over time (baseline material unavailable at this time). An initial conclusion is that fatal and injury accidents are not being affected by ASAP, with a slight suggestion that more fatal injury accidents occurred in the experimental area during one month. There is no clear relationship between ASAP and drivers killed although there is a slight tendency toward less driver fatalities in the experimental area. As the program progresses, it is clear that the ASAP program is reducing alcohol-related (A/R) fatal crashes, especially in the high risk time period. When corrected for the size of each group, ASAP and regular officers, ASAP makes at least three times as many arrests on A/R charges. Also, there is more arrest activity for the charge of operating after suspension by the ASAP officers. In summary, enforcement as a countermeasure is fulfilling its objectives. The question of its relation to the ultimate measures is not clear. ASAP is definitely making more A/R arrests which result in conviction, both crash and noncrash arrests. The BAC (blood alcohol content) of drivers arrested is still high, but improving. There seems to be little distinction between problem and social drinkers in terms of the group causing fatalities. A question which arises is whether ASAP should pursue its effort to reduce fatalities, or shift its priority to accident reduction. ASAP may be reducing A/R fatalities, but the vast majority of drivers involved are not the problem drinkers the program is designed to help. Not to be overlooked is the great increase in arrests with successful prosecution, possibly the most efficient treatment of the drinker driver problem.

Social Systems Res. Corp., Bangor, Maine
1974?; 20p 12ref
Availability: Reference copy only

HS-019 714

**MAINE ASAP 0ALCOHOL SAFETY ACTION
PROJECT0: YORK AND CUMBERLAND COUNTIES.
KEY ANALYTIC STUDY. AN ANALYSIS OF
ULTIMATE MEASURES. UPDATED**

An updated analysis of ultimate measures of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver, concludes that fatal and injury accidents are not being affected by ASAP, with a slight suggestion that more fatal injury accidents occurred in the experimental area during one month of 1972. In comparison to 1971 baseline data the number of fatal accidents per million vehicle miles were slightly less than 1972 figures. Concerning 1970 baseline the fatality rate per million miles was approximately the same for 1972. In 1972 there seemed to be no clear trend toward fewer injury crashes in the demonstration area as compared with 1970 and 1971. There is also no clear relationship between ASAP and drivers killed although there is a slight tendency toward less driver fatalities in the experimental area. As the program progresses, it is clear that the ASAP is reducing alcohol-related (A/R) fatal crashes, especially in the high risk time period. When corrected for the size of each group, ASAP and regular officers, ASAP makes at least three times as many arrests on A/R charges. Also, there is more arrest activity for the charge of operating after suspension by the ASAP officers. In summary, enforcement as a countermeasure is fulfilling its objectives. The question of its relation to the ultimate mea-

The blood alcohol level (BAC) of drivers is still high, but improving. There seems to be little distinction between problem and social drinkers in terms of the group causing fatalities. A question which arises is whether ASAP should pursue its effort to reduce fatalities, or shift its priority to accident reduction. ASAP may be reducing A/R fatalities, but the vast majority of drivers involved are not the problem drinkers the program is designed to help. Not to be overlooked is the great increase in arrests with successful prosecution, possibly the most efficient treatment of the drinker driver problem.

Social Systems Res. Corp.
1973?; 21p 12ref
Availability: Reference copy only

HS-019 715

**MAINE ASAP 0ALCOHOL SAFETY ACTION
PROJECT0. BAC 0BLOOD ALCOHOL
CONCENTRATION0 DATA FOR DRIVERS FATALLY
INJURED. KEY ANALYTIC STUDY**

Blood alcohol level (BAL) data for driver fatality statistics were collected in conjunction with the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver. In Sep 1971, the Maine law was changed so that Operating Under the Influence (OUI) which requires a BAL of 0.10% is the only drinking-driving offense. Another external factor which has affected the reporting of BAL data by the ASAP was increased funding to pay medical examiners to determine BAL in fatal accidents. Also, 1971 baseline period data are not completed, and the evaluation of BAL information will have to wait until these data are available. A problem exists with Implied Consent Refusal forms which are filled out by drivers suspected of OUI who refuse to submit to blood or breath tests. The forms do not contain place of arrest or troop number of State Police so it is difficult to determine if offenses occurred within ASAP boundaries. There are limitations in evaluating BAL data as there are few driver fatalities; but accepting this, no predominant type of driver has been involved in the fatal crashes. Average BAL's for drivers killed, injury, property damage and noncrash arrests were 0.13%, 0.16%, 0.20%, and 0.14%, respectively. It should be pointed out that a true comparison is restricted by the less than 100% BAL testing of dead drivers and the 1972 refusal to have BAL's taken of all arrested drivers. The fatal accident has not been found to be a direct function of the BAL. The highest percentage of fatalities occur up until age 25 and then decreases into the forties with one last peak after age 65. It was found that 49% of driver fatalities were among those who had no previous violation or accident (26% with previous violations or accidents, 19% for solely violations, and 14% for solely accidents). In addition, only 2% of fatal drivers had previous alcohol-related offenses. It is felt from the examination of data that the ASAP is not affecting the accident rate, and the determiners of the fatal accident do not seem directly related to ASAP efforts.

Social Systems Res. Corp., Bangor, Maine
1973?; 18p 4ref
Availability: Reference copy only

HS-019 716

AN ANALYSIS OF CUMBERLAND/YORK (MAINE) ALCOHOL SAFETY ACTION PROJECT ENFORCEMENT ACTIVITY FOR 1972

An analysis of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver, enforcement activity for 1972 shows that ASAP officers, both State and Local make Operating Under the Influence (OUI) and Operating after Suspension (OAS) arrests at a rate-per-man far in excess of non-ASAP contingents. The enforcement component has met its objective during the first year of operation. ASAP OUI arrest-per-man are eleven times higher than the non-ASAP rate and nearly ten times the baseline. The non-ASAP rate in the non-OUI school contingent has actually fallen somewhat below the 1971 baseline rate-per-man. The data for non-ASAP collapsed over ASAP and non-ASAP agencies and subcategorized as to OUI and non-OUI school shows a significantly greater OUI graduate efficiency in per-man OUI arrests that may constitute a catalytic effect. In comparison with ASAP agencies exclusive of the ASAP contingents, non-ASAP agencies perform significantly better in per-man OUI, OAS, and non-alcohol-related (non-A/R) arrests. But OUI school graduates do better than non-OUI if an ASAP agency officer but less well if a non-ASAP agency officer. There is likewise some evidence that the quality of ASAP A/R arrests is superior to non-ASAP in that ASAP arrests lead to more convictions and fewer dismissed cases. Despite this evidence for more arrests of good quality, the overall conviction rate has not increased and may have declined relative to the baseline, 1971, period. The enforcement activity has contributed its part to the ASAP experiment, however, in providing good arrests (10% of arrests met minimal criteria for drinking driving status).

Social Systems Res. Corp., Bangor, Maine
1973; 31p

Availability: Reference copy only

HS-019 717

AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES TO DETERMINE TOTAL PROJECT IMPACT

An analysis has been made of the ultimate performance measures to determine the total of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver. Comparisons were made between a baseline period from 1969 to 1971 and operational years 1972-3, and a control area whose period was 1970-1. Total data and A/R (alcohol-related) subsets of fatal, nonfatal injury, and property damage crashes along with fatalities and injuries were examined for changes over time, within and between project and control areas. Fatalities were categorized as driver and nondriver, and a significant decrease in driver fatalities was observed from 1972 to 1973 in the project area. This difference was attributed to fewer fatalities having the significantly greater attributes of prior major traffic convictions and/or accidents, and elevated blood alcohol concentration (BAC) in the 1973 victim group than in the 1972. Information from roadside research surveys indicated greater awareness of ASAP among self-reported heavy drinkers and the high BAC group than among lighter drinkers in lower BAC groups. Household survey results indicated the general public to be generally indifferent to, and

lacking cognitive information on the drinking driving problem, although rating it as serious. Present findings suggest that it is a mistake to assume that the problem drinker is, ipso facto, a problem driver. The distinction should be made between a problem drinker or an alcoholic who drives, and a problem driver who also has a secondary drinking problem. Such constructs give rise to predictions that problem drinkers would be more likely to accumulate OUI (Operating Under the Influence) offenses, but remain relatively free of major traffic violations and/or crashes. The problem driver with a secondary drinking problem would be more likely to accumulate major offenses and crashes, but remain relatively free of OUI offenses. The "driver" component of the compound work problem drinker-driver must be given the emphasis in research and evaluation. The routine practice of concentrating rehabilitation efforts on second and subsequent OUI offenders is questioned. In regard to cost effectiveness and assuming ASAP impact to be totally responsible for the non-chance component of the reduction in driver fatalities, the minimum net loss for each dollar spent was 35 cents.

by Ross St. Germain

Social Systems Res. Corp., Bangor, Maine
1974; 58p 8refs

An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.

Availability: Reference copy only

HS-019 718

AN ANALYSIS OF THE IMPACT OF ASAP (ALCOHOL SAFETY ACTION PROJECT) ON THE TRAFFIC SAFETY SYSTEM

An analysis has been made of the impact of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver, on the traffic safety system. No change has occurred in the proportion of guilty verdicts in OUI (Operating Under the Influence) cases from baseline 1971 through the second project year. What must be considered, though, is that the presumptive legal BAC (blood alcohol concentration) for OUI was reduced from .15% to .10% in the last quarter of the baseline year. A significant and progressive increase in convictions on reduced charges has been found which can be attributed primarily to an increase in low or borderline BAC's taken at arrest, especially in 1973, which relates to the above-mentioned law change. In a sample of 126 dismissals on OUI charges, the quality of police evidence and demeanor of the officer as a prosecution witness was rated adequate in 82.54% of the cases. Concordance between prosecutor and judge in rehabilitation referrals was greater in 1973 than 1972 but it was accompanied by a decrease in the number of referrals. The agreement between prosecutor and judge suggests a closer working relationship or fewer discriminations of ASAP prosecutors in making recommendations, or both. Arrests and convictions for OUI in 1972 appeared to correct for a 1971 bias against both arrest and conviction of the two highest accident rate age groups: the very young and the very old drivers. This same correction continued to hold in 1973 but slipped partially back to the baseline bias. A significant and progressive shortening of time span from arrest for OUI to guilty verdict was found for both project years over baseline. Since ASAP prosecutors handle this

increased load, at least part of the credit, if not most, must be attributed to them.

by Ross St. Germain
Social Systems Res. Corp., Bangor, Maine
1974: 38p 4refs

An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.

Availability: Reference copy only

HS-019 719

AN ANALYSIS OF DRINKER DIAGNOSIS AND REFERRAL

An analysis has been made of drinker diagnosis and referral of the Cumberland/York (Maine) Alcohol Safety Action Project (ASAP), a program directed toward finding effective countermeasures against the drunk driver. In this project the case of an individual arrested for Operating Under the Influence (OUI) who pleads not guilty to the charge at District Court arraignment, or asks that the case be transferred to Superior Court for a jury trial, is handled by special ASAP prosecutors. If the accused admits to problem drinking, the prosecutor alerts the Social-Medical Component of ASAP; and the decision is made whether or not to offer the ASAP alternatives. If such are offered and the accused individual accepts, recently enacted legislation permits the use of ASAP probation in which traditional penalties of jail and/or fine are suspended. Special ASAP probation officers supervise the case and require attendance at the Alcohol Safety Action Driving School (ASADS). Entry into long-term treatment is encouraged but is not mandatory. At various points in the judicial process, diagnostic tests (Mortimer-Filkins test, psychological evaluation, medical exam) may be performed. Driver history is routinely collected, and diagnosis of drinker status is made on the basis of any or all of these procedures. The person is referred to ASADS and/or long-term treatment by NIAAA-(National Institute on Alcohol Abuse and Alcoholism)-funded facilities in Cumberland County, or community-based or volunteer facilities in York County. A Special ASAP Investigations Officer makes recommendations to the Hearings Officer when a person applies for restoration of driving privileges. From 1 Jan 1972 to 31 Dec 1973, Identification and Referral has made contact with 1085 OUI-arrested individuals in the ASAP area (which is 62.31% of all OUI arrests for same period). Diagnostic work-up in addition to driving history data was given to 16.57%. All individuals were referred to treatment, and 941 were diagnosed problem drinkers, 144 were unclassified. Male and female mean Mortimer-Filkins score were over double the recommended cutoff point for high probability of problem drinking or alcoholism (122.93-male, 113.42-female). It is suggested that the selection procedure is so highly correlated with Mortimer-Filkins results as to render use of the test redundant and wasteful. Evidence from the ASAP has shown that multiple OUI offenses is not a characteristic of driver fatalities who happen to have an unusually high BAC at time of death. Therefore, the wisdom of restricting rehabilitation candidates to the currently selected subgroup of OUI recidivists is open to question.

by Ross St. Germain
Social Systems Res. Corp., Bangor, Maine
1974: 31p

An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.

Availability: Reference copy only

HS-019 720

A STUDY OF THE IDENTIFICATION AND REFERRAL ACTIVITY OF THE CUMBERLAND/YORK (MAINE) ALCOHOL SAFETY ACTION PROJECT, 1972

The Identification and Referral (I&R) Activity had to overcome several problems before it could become a viable program. There were difficulties in obtaining permission for pretrial investigations; judges were reluctant to allow a delay between trial and sentencing, necessary for an investigation upon which to make adequate referral recommendations; and a special probation officer was found necessary and had to be hired. The I&R procedure involved obtaining pretrial information from arrest information from the six District Courts, the Motor Vehicle Division, and the Blood Alcohol Concentration (BAC) data, which information was put on a Court Data Form (CDF). From this information, only those were chosen for Eligibility, Referral and Follow-up (ERF) who had 0.150% BAC and prior Operating under the Influence (OUI) convictions. The prosecution was then notified that the defense attorney would be asked for a pretrial interview of the defendant. Recommendations for treatment were then made to the judge through the prosecuting attorney. In making up the CDF and ERF files, clerical errors occurred which, however, did not affect the results evaluation substantially. Findings are as follows: About 8% of all OUI arrests in 1972 were determined as problem drinkers (PD). Of the total OUI arrests in 1972, 2443, 5% or 120 people were contacted by I&R; 97 of these were referred to driver school, extended treatment, or both. Of the unreferred group, 64.7% were PD's; of the referred group, 47% were PD's and 34% not PD's. The Alcohol Safety Action Project (ASAP) target is the problem drinking driver, one who has a high BAC and repeated drunk driving offenses, a group that comprises less than 10% of the OUI population, which in turn is a small percentage of the total driving population. It is important to distinguish this group from all other alcoholic offenders who show little evidence of being or becoming problem drinking drivers. Otherwise the ASAP effort will be dissipated.

Social Systems Res. Corp., Bangor, Maine
1973: 11p

Availability: Reference copy only

HS-019 721

AN ANALYSIS OF THE JUDICIAL OUTCOME AND PROCESS OF 2443 OPERATING UNDER THE INFLUENCE OF ALCOHOL ARRESTS OCCURRING IN CUMBERLAND/YORK (MAINE) COUNTIES IN 1972

Two groups of Operating Under the Influence (OUI) prosecutions are compared: non-Alcohol Safety Action Project (ASAP) and ASAP-prosecuted. Although guilty verdicts remained proportionately stable for both groups, the non-ASAP group produced a consistent 15% higher rate than the ASAP group. It was determined through profile information that the ASAP-prosecuted sample was about the same as the general OUI population. Twice as many ASAP-prosecuted guilty verdicts were appealed, whereas all other categories of depositions (guilty, nonguilty, dismissed, and continued) remained about the same for both groups. Because of the added burden placed on the court system by additional appeals, ASAP, to avoid negative reaction, must compensate the

counts by producing less recidivism through good rehabilitation programs. Section Two examines the process by which the 667 ASAP-prosecuted OUI charges arrived at final adjudication. ASAP-prosecuted charges resulted in a guilty proportion of 66.1%, 68% of which wind up in Superior Court on appeal and receive dispositions other than guilty; whereas 41% of all OUI arrests are convicted by virtue of the accused pleading guilty of the charge, not entering into plea bargaining, and accepting the District Court verdict. Three percent are found guilty at their Superior Court trials. As for the ASAP failure to obtain a greater conviction percentage, rather than examining the evidence to see if the respondent has committed a crime, the prosecutor made a subjective determination of which respondents are problem drinkers, and then decided whether or not to prosecute. The result was that cases against nonproblem drinkers are dismissed or reduced, while problem drinkers (PD's) are forced to try and often win cases that should have been negotiated. Another factor, difficult to weigh with accuracy, was the inexperience of the ASAP prosecutors, for the most part recent graduates from law school.

Social Systems Res. Corp., Bangor, Maine
1973; 37p

Prepared for Cumberland/York (Maine) Alcohol Safety Action Project.

Availability: Reference copy only

HS-019 722

AN ANALYSIS OF DRINKER DIAGNOSIS AND REFERRAL.

The Identification and Referral program of the Maine Alcohol Safety Action Program (ASAP) submitted data concerning a sample of 1142 Operating Under the Influence (OUI) arrests contacted for problem drinker diagnosis and referral during the period 1 Jan 1972-31 Dec 1974. Of the total sample, 660 received a full-scale pre-sentence investigation, and were diagnosed Problem Drinkers. Ninety-two percent of the group entered treatment. The mean Mortimer-Filkins score of the group was 123.62 with only 4.86% below the cutoff point of 50. A second group received screening for drinker status consisting of driver history and BAC (Blood Alcohol Content) along with, in some cases, interview data. Of 482 persons in that group, 96.89% were referred to the Alcohol Safety Action Driving School only. Of the number referred, 22.91% accepted while 71 (66.26%) of those accepting actually entered. The age distributions of three groups (Problem Drinkers, Unclassified Drinkers Accepting Referral, and Unclassified Drinkers Refusing Referral) showed significant differences. Problem drinkers were over-represented in the 30-54 age group contrasted to the age distribution of the total population convicted of OUI in the 20-50 group, contrasted to Accepting Referral Group; and in the 30-54 age group contrasted to the Refusing Referral Group. The Accepting Referral group did not differ from the age distribution of total convictions, but was over-represented in the 50-65 age group contrasted to the Refusing Referral group. The Refusing Referral group did not differ from the age distribution of total convictions except in the "missing" category. The identification and referral program involving the cooperation of rehabilitation court workers, prosecutors, and judges have succeeded in discriminating among three groups of drinking drivers and of giving highest priority to securing treatment for the most pathological of the three. However, one drawback of this countermeasure must be mentioned: these results are dif-

ficult to interpret because they are based on only a sampling of OUI arrests and the sampling procedure is unknown.

by Ross St. Germain
Social Systems Res. Corp., Bangor, Maine
1975; 26p

An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.

Availability: Reference copy only

HS-019 723

AN ANALYSIS OF THE DEVELOPMENT OF THE CUMBERLAND/YORK (MAINE) ASAP ALCOHOL SAFETY ACTION SCHOOL: DEVELOPMENT AND CLIENT CHARACTERISTICS

The development of the Cumberland/York Alcohol Safety Action Drinking School (ASADS) took 10 months and resulted in the following decisions. Referral would come from the courts where judges agreed to order a payment of a fine and would suspend a one- or two-day jail sentence conditional upon attendance at a required number of ASADS sessions. The school would consist of four curricula based on drinking classification: social drinkers, marginal problem drinkers, problem drinkers, and drinkers 22 years and under. A counselor-coordinator would be hired to assign pupils to specific sessions, schedule classes, certify attendance, and provide individual counseling. Originally, it was decided to run the school in four-week blocks, but these were later reduced to three weeks. Legal problems arose and solutions were proposed: drinking drivers with suspended licenses could attend the schools by transportation provided by civic organizations, and a change in the law was proposed in the Maine legislature granting judges the authority to require ASADS school attendance. Publicity was provided prior to the implementation of the ASADS. When the school became operational, the courts complained of the additional work and the small degree of compensation (lower recidivism) in the future. At the end of the first year from development to implementation, few objective data are available, and any evaluation must be based on the effectiveness of novel procedures. The first sessions of schooling dealt with 65 participants who were referred from a group of 85 arrested operating under the influence (OUI). Subject characteristics are presented based on sex, blood alcohol content and drinker status (problem drinker, and nonproblem drinker) in the referred group and the nonreferred group. The outstanding problem that is arising appears to come from the referral procedure since treatment groups are reflecting a high number of general alcoholics and a low number of problem drinker drivers, including a few first offenders with the implication they present for preventive work.

Social Systems Res. Corp., Bangor, Maine
1973; 11p

Availability: Reference copy only

HS-019 724

THE MAINE ROADSIDE SURVEY. 1972 FINAL REPORT

A roadside survey of drivers in Cumberland/York counties of Maine, including a breath test and a questionnaire, was performed in two stages - a baseline survey in Sep-Oct 1971 and a second in Sep-Oct 1972 - to test the efficacy of the Alcohol Safety Action Project (ASAP) as a deterrent to drunk driving.

The vast majority of drivers surveyed were male, young, white, and had lived in their home county for four or more years; the presence of a college near the test area influenced the baseline survey to have more young people than the second survey, however. That the ASAP program has significantly influenced the attitudes of drivers is shown by a greater variances of the ability to drive safely while intoxicated, a greater support for a tolerance of police efforts to detect the drunk driver (including breath tests and blood tests), and less opposition to the referral of problem drinker-drivers to mental health clinics and to jail sentences for the convicted drunk driver. Driving habits and drinking habits, on the other hand, have not changed. Drivers are less aware of the significance of Blood Alcohol Concentration (BAC) levels and of the legal limit, are not any more knowledgeable about the number of drinks needed to be considered legally drunk, but have started to realize that whatever the legal level, it takes fewer drinks to reach it than they had originally thought. Publicity efforts were only mildly effective: TV spots concerning drunk driving had been noticed, although the name ASAP as the sponsor of the safety campaign was not well known per se. There was a positive relationship between increasing age and frequency of support for every countermeasure except revocation of license. Nondrinkers were significantly more supportive of police measures than were drinkers. There was a decrease in support for harsher penalties, although a slight majority still favors them. The mean BAC for both parts of the survey was 0.009%. There was no difference in BAC between beer drinkers and liquor drinkers. Recommendations for continued ASAP activity include increased educational efforts with a goal of each driver knowing how to calculate his/her point of intoxication, more use of well known personalities for TV spot commercials, positive contacts between police and drivers, characterization of the problem drinker-driver as in need of therapy, and publicizing of alternatives to jail sentences.

Social Systems Res. Corp., 61 Main St., Bangor, Maine 04401
1973; 56p

Availability: Reference copy only

HS-019 725

AN ANALYSIS OF ASAP 0ALCOHOL SAFETY ACTION PROJECT0 PATROL ACTIVITY FROM JANUARY 1, 1972 TO DECEMBER 31, 1974

Alcohol Safety Action Project (ASAP) police patrols of six participating municipalities with a total of seven officers (the ASAP Local group), and a contingent of ASAP State Police consisting of eleven men and one leader were compared with non-ASAP enforcement personnel in the two county-ASAP area of Maine on arrest rates for operating under the influence (OUI), and operating after suspension (OAS). The effect of special OUI training (Countermeasure E9) for non-ASAP officers on the same measures was also examined. In addition, differential detection of the OUI offense was evaluated as measured by differences in mean blood alcohol concentration (BAC) of those arrested by the various ASAP, non-ASAP, special OUI trained, and untrained groups. The quality of police work in the gathering and presentation of evidence was indirectly measured by the proportion of guilty dispositions of ASAP State, ASAP Local, and non-ASAP OUI arrests. Results showed that ASAP patrols, both State and Local, produced significantly more OUI and OAS arrests per man than non-ASAP patrols as a group. The magnitude of the superiority was a ratio of 10:1 for OUI arrests and a three year average of about 5:1 for OAS arrests. Special OUI training

showed the trained group of officers superior to the untrained group in 1972 for OUI arrest rate with a ratio of 1.7:1. In 1973 and 1974, there were no differences between the two groups. When Countermeasure effectiveness was examined for non-ASAP officers of non-ASAP agencies only, significance opposite the predicted direction was found in all three years for OUI arrests, and in 1972 and 1973 for OAS arrests. The untrained officers were superior to the trained with a three year ratio of about 1.3:1 for OUI arrests. The three year superiority of OAS arrest rate, including 1974, was 1.4:1 in favor of the untrained group. These results opposite the predicted direction were felt to indicate a selective factor operating in those volunteering to take the special training, e.g. those attending may have been less likely to be on alcohol-related patrol duty as often as those who did not volunteer for the course. In any event, no support for the effectiveness of Countermeasure E9 in terms of increased OUI or OAS arrests was found. The predicted direction of significance found in 1972 was attributable more to the very low production of untrained non-ASAP officers of ASAP agencies, than to superior performance of the trained group. There were no differences in mean BAC of those arrested by various police groups in 1972, but in 1973 ASAP State Police OUI arrests showed a mean BAC significantly lower than ASAP Local, non-ASAP State, and non-ASAP Local. No other group differences were found. In 1973, ASAP State Police arrests showed a mean BAC significantly lower than ASAP Local arrests but no other group differences were found. These results were felt to indicate superior detection abilities of ASAP State Police over the other groups in 1973, but only over ASAP Local in 1974. Discussion of results centered around the explanation of the significantly greater OUI and OAS arrest rates of the ASAP patrols over the non-ASAP. No evidence was found to indicate that the explanation is other than the day, time, place, and emphasis of the patrol. The study did not include any measures that could shed light on the apparent superiority of ASAP State Police in OUI detection and quality of police work.

by Ross St. Germain

Social Systems Res. Corp., Bangor, Maine
Rept. No. AS-3; 1975; 30p

An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.

Availability: Reference copy only

HS-019 726

AN ANALYSIS OF THE IMPACT OF ASAP 0ALCOHOL SAFETY ACTION PROJECT0 ON THE TRAFFIC SAFETY SYSTEM

Comparison of disposition data for operating under the influence of alcohol (OUI) arrests in baseline year 1971 with project years 1972 and 1973 showed no change in the proportion of guilty dispositions over time, but a significant increase in guilty verdicts to reduced charges. Not guilty and other non-penalty dispositions decreased over the same time period. The age distribution of OUI arrests changed significantly from a baseline that under-represented the high accident risk groups in the baseline year to one that approximated those groups in the 1972-1974 project years. In addition, baseline age distribution of convictions showed under-representation of the already under-represented high accident age groups. By contrast, age distributions of convictions during the project years were homogenous with the arrest distributions. The length of elapsed time between arrest and guilty dispositions was shortened significantly in project 1972-1974 over baseline 1971.

effect on the traffic safety system but pointed out the absence of quantitative data with which to test ASAP hypotheses that make explicit the interdisciplinary team approach to the problem drinker driver.

by Ross St. Germain
Social Systems Res. Corp., Bangor, Maine
Rept. No. Analytic-study-4; 1975; 26p 4refs
An analytic study of the Cumberland/York (Maine) Alcohol Safety Action Project.
Availability: Reference copy only

HS-019 727

THE OPTIMIZATION OF BODY DETAILS--A METHOD FOR REDUCING THE AERODYNAMIC DRAG OF ROAD VEHICLES

In order to make use of the potential of aerodynamics, a procedure called detail optimization has been developed by Volkswagenwerk AG to reduce drag in the front end, the front roof support (A-pillar), and the rear end. Drag in the front end depends on the nose shape and position of the spoilers. To achieve best nose shape, an optimum nose ("optimung nose") was developed and changes in nose shape were brought into conformity with the optimum nose as much as possible. Air drag also is affected by the front roof support, which depends on the position and curvature of the windshield, front end design and the drain lip. Particular attention must be paid to the drain lip not only to lessen air drag but to avoid water spillage over the side windows and into the interior when the car door is open and the car at a standstill. The air flow pattern in the rear end is determined by the flow regime of the front and the windshields and by overall dimensions of the back end. The following details can be altered to reduce air drag in the rear end: height of trunk lip and lid, rear-end elevation, narrowing rear and side panels, rear spoiler and rear axle lift, contour of rear end of roof and C-pillar, and rear door lid gap. In testing this procedure in a wind tunnel, care must be taken in the air tunnel results. Marginal differences can result between measurements in air tunnels and real life. Since optimization is based on marginal effects, air tunnel results can be unreliable for accurate measure. Further discrepancies can result from using various size models and extrapolating to full size vehicles. In particular the quarter scale model presents difficulties. The optimization method, if applied systematically during the design procedure, can yield a remarkable improvement in the aerodynamic quality of cars.

by W. H. Hucho; L. J. Janssen; H. J. Emmelmann
Volkswagenwerk AG, Germany
Rept. No. SAE-760185; 1976; 20p 12refs
Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 728

THE BODY SHAPE OF MINIMUM DRAG

A theoretical method to determine the shape of a car body when particular lift distribution is imposed was developed by Pininfarina to meet the following conditions: total aerodynamic lift equal to zero, and gradual area and shape variations of the transverse sections of the body. Two models were made based

on basic theory and their fairings. The models were built in half scale as the best compromise between low model cost and reliability of aerodynamic results. They were then tested in the wind tunnel, and although total lift and pitching moment were not exactly equal to zero, the drag values appeared good for both models. In particular, about 20% absolute reduction of the lift distribution was thought to be caused by necessary outlets of cooling air in the front lower part of the body. This effect, along with minor changes in the central part of the body will lead to zero total lift and pitching moment. The necessity for cooling and conditioning airflow will cause an increase in drag. Sometimes a reduction in drag was found by opening air intakes and outlets. A 0.15 m cutoff of the tail increased the drag coefficient. When the total length was reduced to 4.1 m, the drag penalty did not seem too high and may even be advantageous. Finally, drag increase due to slots and surface unevenness, such as windows or windshield contours and underbody details, is difficult to evaluate, and their influence depends on location as well as size.

by A. Morelli; L. Fioravanti; A. Cogotti
Politecnico di Torino, Italy; Res. Centre, Pininfarina, Italy
Rept. No. SAE-760186; 1976; 12p 16refs
Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE
1976; 13p 12refs
Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 730

AERODYNAMIC EFFECTS OF FRONT END DESIGN ON AUTOMOBILE ENGINE COOLING SYSTEMS

A Cooling System Airflow Management Program was conducted to develop the capability of determining, in wind tunnels, vehicle front-end aerodynamic effects on engine cooling system airflow. Traditionally, the determination of these types of airflow effects has been difficult to obtain due to the upward and outward curvature characteristics of the capture stream tube ahead of the grille, as well as the turbulent characteristics of the expanding airflow directly behind the grille and bumper. A testing technique utilizing a rake of multiple vane-anemometers was developed to determine the total airflow and airflow distribution. A 1974 Pinto with a 2300 cc engine and a 1974 Mustang with a 2800 cc engine were selected as baseline test vehicles. The vehicles were equipped with automatic transmissions and air conditioning systems. The original radiators were removed and identical radiators, modified to accommodate the vane-anemometer rake, were installed. Testing was conducted at nominal freestream velocities of 30 and 60 mph. For each operating condition, the vane anemometer rake was manually traversed over the entire rear face of the radiator and two data points were obtained for each location and each anemometer. Five configurations were tested: complete cooling system plus contour seals (Pinto only); complete cooling system less contour seals; fan and shroud removed; air dam removed; grille removed; and bumper removed (stripped configuration). Results show a fairly consistent total loss and total recovery percentage between the Pinto and Mustang, although component effects differ. On both vehicles, installation of an air dam resulted in substantial improvements in ram airflow. A large portion of the ram air losses sustained as a result of installation of the

covery is obtained with the installation of the fan and shroud on both vehicles, although the close proximity of the fan to the radiator in the Pinto reduces the fan efficiency. This technique presented a complete point-by-point picture of the velocity distribution over the entire rear face of the radiator, and the following can be identified or illustrated: blockage - high and low velocity points; potential ineffective cooling areas; fan/shroud performance; and vehicle-to-vehicle comparisons. The technique provided excellent results, and it was determined that it was possible to quantify the total airflow and distribution as effected by various front-end, flow area components. The effects of the bumper, grille, air dam, fan and shroud were clearly discernible.

by M. E. Olson
Ford Motor Co.
Rept. No. SAE-760188; 1976; 12p 6refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 731

A PARAMETRIC INVESTIGATION OF THE VALIDITY OF 1/25 SCALE AUTOMOBILE AERODYNAMIC TESTING

Aerodynamic forces and underbody boundary layer profiles were measured in wind tunnel tests using 1/25 scale models. This scale allowed the use of fairly realistic models while keeping costs at a minimum. To measure the small changes of the aerodynamic forces, a strain gage force balance was used, a three-component type which can be used to measure normal and axial forces and pitching moment about the moment center. A suspended rectangular ground plane was installed on which was placed the model. Two models were chosen: a plastic scale model of a 1975 Plymouth Duster and a similar sized and shaped plexiglass simple model. The study of the effects of Reynolds number (Re) on the model forces was conducted by simply varying the tunnel velocity and making appropriate underbody measurements. Several profiles were taken to insure repeatability: velocity profiles were measured before and after the air gap with and without the model on the ground plane. When results of this testing were compared to results of tests using larger models, similarities were found which support the use of small-scale models in automobile aerodynamic research. The flow under small models was found to be of the same form as that found under larger models and is a good representation of the undercarriage flow field. The trends of Re were found to be similar to those obtained for larger models; therefore, it was found to be less important to attempt to match Re through increased model size for parametric studies than had been theorized. Finally, results obtained with this type of ground plane compared well with those obtained on fixed ground planes which indicated this mounting method is adequate when used in parametric studies. The agreement of the data with previous results also supports the possibility of a method of correction for boundary layer growth of fixed ground planes used in automobile model testing.

by Marvin E. Doberenz; Bruce P. Selberg
University of Missouri at Rolla
Rept. No. SAE-760189; 1976; 16p 14refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HUMAN ENGINEERING DESIGN CRITERIA FOR MILITARY STANDARDS: PAYOFFS AND PITFALLS

The most visible human engineering standard in current use is MIL-STD-1472, "Human Engineering Design Criteria for Military Systems, Equipment and Facilities." Using this document as an example, benefits of and precautions in its use are explored. It is essential to know that a standard is not a Specification or a Handbook; standards limit design. A Human Engineering standard influences design in the following ways. Individual provisions may be binding or nonbinding. Each may be expressed as quantitative or qualitative requirements. Usage is likely to be most beneficial and least controversial when requirements are expressed quantitatively. Human engineering design standards, as a whole, are more appropriately applied as mandatory, rather than guidance documents from which a customer desires a human engineered product and must prescribe design criteria prior to the start of work and on a "one shot" basis. Human Engineering design criteria have been established as a result of research data, population stereotype considerations, arbitrary standardizations and common sense. Revision of the standard is a lengthy and sometimes painstaking affair, but the process ensures incorporation of the latest useful information into the standard, facilitates exposure of the proposed changes to a maximum number of human factors and other reviewers, makes industry an active participant in the review and evaluation process and tends to minimize the likelihood of errors remaining in the standard after publication. The use of the standard pays off in saving technical manpower, being a convenient and inexpensive way to prescribe human engineering design requirements, being readily available and familiar, ensuring mutual understanding between designer and customer, representing a general consensus, and ensuring necessary uniformity. Drawbacks or pitfalls include the standard necessarily never being complete, occasions of product acceptance impeded as a result of nonintended interpretation, and conflicts with characteristics of qualified or readily available parts.

by Gerald Chaikin
U.S. Army Human Engineering Lab.
Rept. No. SAE-760190; 1976; 10p 7refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 733

SOME RECENT TRENDS IN HUMAN FACTORS TESTING

Three recent Army decisions have altered traditional concepts of human factors (HF) testing: make maximum utilization of contractor's test data; transfer responsibility for materiel test design and evaluation from the Test and Evaluation Command to the Army Materiel Systems Analysis Activity; and make "effective initial field operation" of new materiel a primary goal of the Army Materiel Command. The impact of these decisions on testing can be expressed as a need for an HF engineer to present HF data in terms of the system rather than the humans who operate and maintain the equipment. The operator should be considered as an integral part of the system. HF data should fit into five categories: effectiveness, reliability, availability, maintainability, and training (including length, type and cost of training as well as measurement of trainee proficiency). The implication for contractors is that

contractors will become testers of their own products. Contractors will include both development and operational costs. The RFP (Request for Proposal) is the document which should speak with greatest clarity about what HF data the contractor should gather and how. Proposal evaluators will be looking for a work statement for an HF program reflecting activities to accomplish the design objectives stated, and a narrative, when required, explaining how the required information of each data item will be obtained.

by John L. Miles, Jr.
U.S. Army Human Engineering Lab.
Rept. No. SAE-760192; 1976; 8p 13refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 734

CHARGER XL: A LIGHTWEIGHT MATERIALS DEVELOPMENT VEHICLE

The substantial development of efforts made by the steel and aluminum industries have resulted in high strength-to-weight ratio materials that can be employed to achieve significant vehicle weight reduction. This total vehicle weight reduction is the sum of the initial weight savings attributable to lightweight material substitution and the iterative weight savings resulting from component weight interactions. As an experimental application of the theoretical concept of vehicle interactive weight reduction, Charger XL was developed by the Chrysler Corp. It is a lightweight materials development vehicle, 630 lbs (286 kg) lighter than its current standard production counterpart. Weight reduction was achieved in the upper and under body by substituting for current materials reduced gauge low carbon and high-strength steel, aluminum, magnesium, lightweight polyester, and thin glass. These weight reductions then permitted further chassis reduction where high strength-to-weight ratio materials were substituted for current materials. Lightweight materials substitution accounted for 375 lbs (171 kg), while the interacting savings accounted for the remaining 255 lbs (115 kg). Further weight reduction could have been realized, but decisions regarding the quality of the vehicle and its manufacturing costs permitted no further reduction. The Charger XL was not to sacrifice its current image of luxury, quiet ride, or good handling, and only "off the shelf" components were to be used in the manufacture. Fuel economy of up to 197 over total vehicle life (based on 1976 Standards) will be realized throughout the additional mpg achieved by the Charger XL -- from 13 to 17 mpg in the city and 18 to 22 mpg in the country, and the energy saved in production. Time before full-scale production is estimated at 2 to 3 years because of the need for further property refinements in the auto industry, and the time required for suppliers to produce the materials in sufficient quantity.

by D. G. Adams; S. Dinda; R. A. George; R. W. Karry; A. S. Kasper; J. Pogorel; W. E. Swenson; W. L. Weeks
Chrysler Corp., Materials Engineering
Rept. No. SAE-760203; 1976; 15p 12refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 735

STIFFENING METHODS FOR SHEET STEEL

Reduction of steel sheet thickness as a means of reducing vehicle weight may necessitate some method of enhancing flexural stiffness. Three basic types of sheet stiffening methods have been investigated: integrally formed rib stiffeners, foam-backed sheets, and embossed material. Means of calculating the stiffness obtained by each method are presented. The stiffness of integrally formed rib-stiffened sheets depends on the size and spacing of the ribs. The increase in stiffness of foam-backed sheets depends on the thickness and density of the rigid plastic foam. Embossed patterns increase sheet stiffness provided the embossing is relatively deep compared to sheet thickness. Small test panels (6x12 inches) representing each of the stiffening methods except deep-textured embossing were tested using cantilever beam loading. Dead load weights were suspended across the 6-inch width at a span length of 8 inches. Deflection at the load line was measured at midwidth using a dial gage. Data from tests on deep-textured embossing were obtained from the manufacturer.

by John N. Macadam
Armo Steel Corp.
Rept. No. SAE-760204; 1976; 8p 4refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 736

PHOTOELASTIC STAMPING ANALYSIS ADDS VISION TO NEW AUTOMOTIVE MATERIAL DEVELOPMENTS

Chrysler Corp. developed a new technique, the Photoelastic Stamping Analysis, for analyzing forming strains induced in sheet metal stampings. This employs thin plastic photoelastic coatings to visually illuminate the overall forming, strain, distributions, and magnitudes on the surface of formed parts. The Photoelastic Stamping Analysis modifies the established procedure to extend the photoelastic strain measurement capabilities from the elastic region to cover the total range of plastic deformation. It was developed to assist in resolving design and manufacturing problems related to developing materials for stamped sheet metal parts. An experimental door panel was stamped from five different metals: two low carbon steels, a nitrogenized steel, and two aluminums to determine the relative formability of these materials for this shape. Qualitative aspects showed areas of no strain activity, areas of high strain gradient, and areas of material discontinuity, i.e., yield or fracture location. Quantitative strain data provided point-by-point measurement of principal strain directions and principal true strain magnitudes. Greatest strains of both types were found in the nitrogenized steel panel. Comparisons of this technique with the Etch Circle Strain Technique reveal much greater capability with the Photoelastic Stamping Analysis.

by W. E. Swenson, Jr.; J. Pogorel
Chrysler Corp.
Rept. No. SAE-760205; 1976; 15p 14refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.

April 30, 1977

HS-019 737

GM 980X - A UNIQUE HIGH STRENGTH SHEET STEEL WITH SUPERIOR FORMABILITY

A simple treatment transforms some commercially available 980X steels into a product with the following desirable mechanical properties; yield strength of 950X steels in the as-treated condition but equal to that of 980X steels after 2-3% deformation; tensile strength of 980X steels; superior formability equal to or better than that of 950X steel in hot rolled gages, i.e., thicker than 2 mm (0.075 inches), and approaching that of plain carbon steel in cold rolled gages. This material, designated GM 980X, could significantly increase the use of 980X steels in automotive applications. The investigations were conducted using sheet samples from one heat of a titanium-strengthened 980X steel, two heats of a vanadium-strengthened 980X steel and corresponding 950X steels. Standard size tensile specimens were machined from all as-received steels and from annealed panels of the 980X steels. Tension tests were conducted on these specimens at room temperature. Annealing of the steels was done in a neutral salt pot, the samples were then air cooled and washed with cold water. Forming limit curves (FLC) of as-received and annealed steels were determined. The strain aging response of the annealed and as-received steels was then determined. The effect of annealing on cold rolled specimens was studied and FLC's were determined from these panels. The vanadium steel appears to be better suited for this process than the titanium steel.

by M. S. Rashid

General Motors Corp., Res. Labs.

Rept. No. SAE-760206; 1976; 15p 13refs

Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.

Availability: SAE

HS-019 738

HIGH-STRENGTH STEEL FOR COST EFFECTIVE WEIGHT REDUCTION

In substituting high strength steels for low carbon steels in automobiles, factors such as weight reduction, design parameters, and cost effects of weight reduction must be considered. Automotive weight reduction is complex because the parts are functionally interrelated, but experience has shown that high-strength material substitution can be achieved with minor modifications to existing designs and tooling to partially offset the spiralling weight increase mandated by safety and emission regulations. The design parameters, formability, loading condition, springback, denting, and corrosion, must be considered so as to achieve the best results with each particular high-strength material. Regarding cost effects, hot rolled steels of yield strength about 45 to 50 ksi and cold rolled steels of about 40 to 45 ksi would be the most usable material for automotive components from cost and manufacturing standpoints. Large future demands for cold rolled high-strength steels make its development imperative. Stamping trials using high-strength steels on chassis and body parts (rear anchor crossmember, idler arm bracket, front suspension crossmember, door outer panel, rear rail, door impact beam) showed that problems in forming due to cracking, loose metal, and wrinkle can be

HS-019 740

change and die modification. Parts have to be designed for high-strength steels to take full advantage of higher strength.

by S. Dinda; R. W. Karry; A. S. Kisper

Chrysler Corp., Materials Engineering

Rept. No. SAE-760207; 1976; 12p 14refs

Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.

Availability: SAE

HS-019 739

A NEW CONCEPT IN FORMABLE HIGH STRENGTH STEEL

A new approach to forming high-strength steels involves a relationship between steel composition and heat treatment which allows specific steels to be formed at low-strength levels (40 ksi) and subsequently strengthened, without distortion, by a martensitic transformation. Low carbon steels will form martensite when slow cooled and thus, in the hot-rolled condition, have yield strengths in excess of 100 ksi. To form these steels they must first be softened by a subcritical heat treatment which softens (recrystallizes) the steel. After forming, the high strength of the steel may be restored by heating the formed part above the critical temperature and slow cooling it. Slow cooling the formed part is essential in eliminating distortion.

by S. J. Donachie

International Nickel Co., Inc.

Rept. No. SAE-760208; 1976; 8p

Presented at Automotive Engineering Congress and Exposition, Detroit, 23-27 Feb 1976.

Availability: SAE

HS-019 740

HIGH STRAIN RATE BEHAVIOR OF SOME HOT AND COLD ROLLED LOW CARBON STEELS

The high strain rate behavior of three types of low carbon steel has been investigated in the strain rate regime of 0.006-100 sec (-1): hot and/or cold rolled rimmed steels, aluminum killed steels, and high-strength low alloy steels with various combinations of cold rolling and aging treatments. The tensile properties reported at four strain rates in the above range are yield strength; tensile strength; yield point, uniform, and total elongation; strain hardening exponent, and strain rate sensitivity. The low carbon steels tested in the program exhibit strain rate sensitivity. Both the yield and tensile strengths rise with strain rate. The strain rate hardening exponent value is observed to be at a maximum at the yield point and to decrease with increasing strain. A correlation between the strain rate hardening exponent value and the static flow stress has been found, and the strain rate hardening exponent has been found to be relatively independent of the strengthening mechanisms or processing variables used to achieve higher flow stresses within the range of steels and conditions tested. The uniform elongation and strain hardening exponent decrease with increased strain rate, while the total elongation remains essentially the same.

by Ashok Saxena; David A. Chatfield

HS-019 741

DIESEL VEHICLES?--CRUDE OIL SCENE

The fuel economy of the diesel engine surpasses that of the throttle controlled spark ignition (TCSI) engine when idling and under part-load conditions because the diesel engine with no throttle has a higher compression ratio and uses a leaner fuel-air mixture resulting in greater thermal efficiency. When comparing fuel economy of the two engines, the diesel's consumption is lower regardless of displacement, miles travelled per gallon, or vehicle weight in urban driving (part load). Crude oil, a liquid form of stored chemical energy, and the most widely used of all energy forms, is highly desirable because it is easily transported and can be fairly easily converted into other liquid forms of high-energy density fuels. Nonetheless, the supply at present usage rates will be depleted within 60 to 100 years. Other nations' usage rates are surpassing those of the U.S. The following methods are being developed to increase the oil supply: Alaskan pipeline, off-shore and deeper ocean drilling, stripper wells, tertiary recovery methods on existing oil wells, and production of synthetic crude oil by processing coal and shale oil. The costs of producing synthetic crude oil are high and many technological and production problems must be overcome; but, based on the assumption that the price of crude oil will continue to rise, the production of synthetic crude oil becomes economically feasible and must be undertaken. The technology for developing the synthetic fuel requires an approximate 10-year lead time.

by O. A. Uyehara
University of Wisconsin, Dept. of Mechanical Engineering,
Madison
Rept. No. SAE-760210; 1976; 20p 17refs.
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 742

APPROACHES TO LOW EMISSION LEVELS FOR LIGHT-DUTY DIESEL VEHICLES

Approaches to low emission levels for a light-duty diesel vehicle were studied according to the 1975 Federal Test Procedure (FTP), using a Toyota Land Cruiser in the 4,000-lb inertia weight class, equipped with a Toyota model B diesel engine, 4-stroke, 4-cylinder and 3-liter displacement with a swirl chamber. A simulation method based on an emission map measured in steady state was developed and proved to be very useful for an efficient study of the effects of various vehicle design factors. The attainable emission levels of smaller diesel passenger cars were also estimated using this method. The following engine modifications were tested and resulted in lower emission levels for the swirl chamber diesel engine: adopting a reverse flow damping valve; reducing injection nozzle sac volume; improving intake and exhaust valve stem oil seal design; controlling injection timing more precisely by engine speed; controlling injection timing by load; adopting swirl chamber with a "stair"; changing injection nozzle location toward glow plug; and increasing throat area. Further lower emissions were obtained by the reduction of the transmission gear ratios, effective because of the decrease in exhaust gas volume. Use of an exhaust gas recirculation (EGR) system and an oxidation catalyst further reduced hydrocarbon (HC) and carbon monoxide (CO) emissions, but oxides of nitrogen (NOx) emission reduction was found to be based solely on drivability. It was concluded that the primary target of HC

0.41, CO 3.4, NOx 1.0 g/mi could be achieved by engine modifications and appropriate transmission and final gear ratio choice for the 4,000-lb class vehicle with some penalty in power and fuel economy. However, the ultimate target of HC 0.41, CO 3.4, NOx 0.4 g/mi is impossible to achieve for the 4,000-lb class vehicle and very difficult for smaller passenger cars, even if an EGR system and an oxidation catalyst are adopted.

by M. Amano; H. Sami; S. Nakagawa; H. Yoshizaki
Toyota Motor Co., Ltd., Japan
Rept. No. SAE-760211; 1976; 18p 2refs.
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 743

A SERIES OF LIGHT DUTY INDIRECT INJECTION DIESEL ENGINES

The SD series is a family of compact diesel engines that can replace the present gasoline counterparts without any major changes in the chassis. General engine layout changes are as follows. The spark plug portion is replaced by a swirl chamber and injector, and an injection pump is added to the camshaft side of the engine. The timing chain is replaced by a gear train. The carburetor is replaced by a venturi for a pneumatic governor. Improvements are made continuously, and it has been determined that exhaust emission characteristics of the SD engine can be improved with a modified fuel injection system. When the SD series was adapted to V8 engines, there was little success: the bore-to-stroke ratio seemed to be too small. However, with selection of a slightly larger bore and adoption of a compact distributor-type injection pump, a V8 engine should be possible in the near future. Installing a diesel engine in a passenger car requires careful attention to the following items: initial cost, engine weight and package size, exhaust emissions, noise, cold starting, roughness, and drivability. For maximum fuel economy, gearing to give a lower engine speed for cruising is recommended. Noise, roughness and drivability are the most difficult items among the critical acceptance factors of a diesel car. Noise is affected by engine temperature and is very high at cold starting. Careful design of the rear suspension and engine mounting is required to avoid resonant vibrations of body panels, very prominent at certain speeds, and a major cause of roughness. The four-cylinder diesel engine requires a rear box of four speeds or more for satisfactory drivability. All other items can be tolerated or solved by the manufacturer.

by Yutaka Hayashi
Nissan Diesel Motor Co., Japan
Rept. No. SAE-760212; 1976; 73p 5refs.
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 744

A MODIFICATION OF COMBUSTION SYSTEMS FOR LOW EXHAUST EMISSION AND ITS EFFECTS ON DURABILITY OF PRECHAMBER DIESEL ENGINE

Key points of tuning combustion systems of a precombustion chamber diesel engine to lower exhaust gas emission level are the decrease of the prechamber volume, selection of the com-

bustion chamber configuration, injection nozzle characteristics, and optimum injection timing. Two important durability problems are lubricating oil degradation and cavitation pitting on the cylinder liner wall. Lubricating oil degradation involves two main factors: an increase of the diffusion burning ratio in the precombustion chamber and an increase of the impinging area on the cylinder wall by the partly burned gases pumped out from the precombustion chamber. The piston ring design, injection nozzle shape, combustion chamber configuration, and quantity of dispersants all have an influence upon the degradation of the oil. Cavitation pitting on the cylinder liner due to change of the combustion systems for exhaust emission control was solved. The cause of the pitting was liner vibration due to the so-called shock load induced by the combustion pressure. It was solved by offsetting the gudgeon pin of the piston.

by Takashi Suzuki; Kozi Usami
Hino Motors, Ltd., Japan
Rept. No. SAE-760213; 1976; 19p 5refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 745

APPLICATION OF FUEL SPRAY THEORY TO EXHAUST EMISSION CONTROL IN A D.I. 0DIRECT INJECTION0 DIESEL ENGINE

Good fuel-air mixing in the fuel spray developed into the quiescent air depends on high kinetic energy of the spray motion. From a theoretical analysis of fuel spray motion in the quiescent air and a photographic study of fuel spray combustion, it was found that a higher rate of air entrainment into the fuel spray using its own kinetic energy is very important in increasing combustion efficiency and reducing soot formation in the diesel engine. Consequently, an intake port was designed for high volumetric efficiency but low swirl generation in order to charge sufficient air into the cylinder. An improved fuel injection system was included to permit high injection rate and high injection pressure so as to obtain high cycle efficiency and good fuel-air mixing in the quiescent air. After many tests had been performed on a single-cylinder engine, a D.I. multicylinder diesel engine with high cycle efficiency and low smoke density was developed and tested. The fuel injection timing of this engine is retarded to reduce the oxides of nitrogen in the exhaust gas. The fuel injector and fuel injection timing at light loads are improved to reduce the hydrocarbons in the exhaust gas.

by Hiroshi Nakagawa; Mataji Tateishi; Masaaki Sekino
Mitsubishi Heavy Industries, Ltd.; Japan; Mitsubishi Motors
Corp., Japan
Rept. No. SAE-760214; 1976; 20p 5refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 746

THE COMBUSTION AND EXHAUST EMISSION CHARACTERISTICS AND STARTING ABILITY OF Y.P.C. COMBUSTION SYSTEM

The Y.P.C. combustion system utilizes a swirl-type precombustion chamber in small diesel engines to improve high-speed

performance while maintaining low exhaust emission. This system combines features of the conventional precombustion and the swirl chambers. The system consists of a rear cell, which has a fuel nozzle on its center line accounting for about 80% of the volume of the divided chamber, and a front cell connected by four throats. Both cells are connected so that their center lines are not in a straight line. Tests were performed using a single cylinder engine with a 102-mm (4.02 inch) cylinder bore and a 106-mm (4.17 inch) stroke, and a speed of 2,400 rpm. Adjustments were made so as to achieve optimum performance in the volume ratio, area ratio, deviation, length and form of the combustion chamber, throats, and relative position of the fuel nozzle and throats. Results showed improvement in fuel consumption and lower exhaust emissions. In addition, starting ability at low temperatures improved, and use of a variety of fuels produced little change in performance. The Y.P.C. system is an attractive option in diesel engines in which it is difficult to adopt the direct injection system.

by Eiichi Motoyoshi; Tadashi Yamada; Mitsuyoshi Mori
Yanmar Diesel Engine Co., Ltd., Japan
Rept. No. SAE-760215; 1976; 16p
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-019 747

MOTOR CARRIER ACCIDENT INVESTIGATION. ADAMS PRODUCE COMPANY ACCIDENT-- FEBRUARY 16, 1976--LAKE PLACID, FLORIDA

An accident involving a tractor semitrailer combination operated by the Adams Produce Company, Forest Park, Georgia and a school bus operated by the Highlands County School Board, Sebring, Florida occurred on 16 Feb 1976, 7:38 a.m., at the intersection of U.S. Route 26 and State Route 621/17 near Lake Placid, Florida. In heavy fog the truck ran a red light, entered the intersection, and collided with a side of the school bus. Four fatalities, 46 injuries, and \$29,000 property damage resulted. The probable cause of the accident was determined to be the truck which was operated at a speed too fast for existing conditions, and the probable failure of the truck driver to wear his glasses.

Federal Hwy. Administration, Bureau of Motor Carrier Safety.
Washington, D.C. 20590
Rept. No. 76-3; 1976; 13p
Availability: Corporate author

HS-019 748

AN AUTOMOTIVE CVT 0CONTINUOUSLY VARIABLE TRANSMISSION0

A continuously variable transmission (CVT) of the modern traction type design is the key to an optimum automotive propulsion system and therefore, to maximum fuel economy. The cone roller toroidal drive (CRTD) is the basis of the wide ratio range transmission. Actual power transmission is through the lubricant's resistance to traction shear under high contact pressure. Lubricants are measured according to their coefficients of traction. A light viscosity naphthenic base oil is generally used in traction drives. In a toroidal type drive the rolling contacts behave like classical ball bearings. The geometry of the CRTD resembles a bevel gear with rolls in a

straight line. The CRTD uses a hydraulic system which equalizes the tangential forces on the power roller rather than the ratio position of that roller. The individual rollers automatically adjust for variations in manufacture and assembly in order to share the load. No combination of overload or shock can produce traction slip with the CRTD's mechanical load cam arrangement. With the control of spin in the traction contact, surface wear and polish are eliminated and thermal stress has no effect. The basic number of power rollers in a toroidal cavity is two to maintain force balance. The CRTD uses two rollers for maximum stability and cost effectiveness. These are cross connected in the cavity with a flexure arrangement not possible with three or more rollers. The CRTD provides acceptable mechanical control by balancing engine rpm signal with engine torque signal, a function of the drive torque and ratio. CRTD is a technically mature and tested CVT, capable of automotive horsepower, totally immune to sudden or shock loads and able to operate indefinitely with no surface wear or polish. Efficiency is generally in the range between 90% and 95% over the entire ratio and load range.

Publ: Mechanical Engineering v98 n10 p38-43 (Oct 1976)
1976; 5refs
Based on a paper contributed by the ASME: Automatic Control Div.
Availability: See publication

HS-019 749

ELECTRONIC ENGINE CONTROL: A DRAPER-LI BREAKTHROUGH RIPENS IN 25 YEARS

The Draper-Li optimizing control concept in electronic engine controls has significant advantages over the preprogrammed and the error-correcting closed-loop controls. It employs the closed-loop feedback principle, which corrects its own performance, but rather than seeking a setting that the designer thinks the engine wants—the preprogrammed control, the Draper-Li control system lets the engine tell the controller what it wants or likes best. Best power and best fuel economy are thus achieved at the same time. Further development of the Draper-Li system by Harmon Electronics has resulted in a compact arrangement intended as a retrofit for the after-market and can be installed in in-use vehicles without replacing or modifying existing engine parts.

by Paul H. Schweitzer
Optimizer Control Corp., State College, Pa.
Publ: Mechanical Engineering, v98 n9 p35-7 (Sep 1976)
1976; 1ref
Based on a paper contributed by the Automatic Control Div.
Availability: See publication

HS-019 751

170 MILLION DEFECTIVE TIRES PER YEAR

Some considerations it is thought should be made by tire companies in an effort to make safer tires are discussed. Perhaps the most critical factor in the life of a tire is heat build-up which occurs if tires are overloaded or underinflated and "flexing" of the tire's components increases in magnitude and tire components deteriorate. But tire companies have done little to educate the public of this hazard, and tire designs tend to disguise conditions of underinflation. Other problem areas which are discussed include defects such as bead failure, ply separation, tread separation, inadequate inner liners, dan-

gerous hinge points, and defective cords. Tires should be 100% inspected at each critical stage of fabrication. Treads should be designed for maximum traction for all types of road conditions. Tires should be of the proper size and load range, as well as compatible, for a particular vehicle. A tire should have adequate warnings and instructions regarding mounting procedures. Tools which must be used by the prudent tire designer and manufacturer to identify safety risks (and which are available to a trial attorney investigation tire-related injuries or death) include patents and patent applications, recall campaign literature (NHTSA), statistics, case histories, testing data, product specifications, factory worker and union member information, tire industry ads, auto company specifications, government and industry standards and codes, and various literature available on the subject. A few of the safety features available to tires, but largely unused by the tire industry, include self-sealing tires, run-flat ("total mobility") tires, and dual-chamber tires. It is suggested, in conclusion, that tire companies concentrate on fewer styles and better designs.

by Harry M. Philo; Arnold D. Portner
Publ: Trial v12 n11 p50-3 (Nov 1976)
1976; 3refs
Availability: See publication

HS-019 752

COLOR VISION TESTING IN OPTOMETRIC PRACTICE

Absolute color blindness is extremely rare and is usually associated with other serious vision problems. Color vision defects (C.V.D.) may be hereditary or acquired secondary to ocular pathology. While hereditary C.V.D. are almost always "red-green" affecting 8% males and 0.5% females, acquired C.V.D. are more often "blue-yellow" and affect each sex equally. Patients with hereditary C.V.D. rarely misname colors as opposed to patients with recent changes in color vision. Hereditary C.V.D. affect the two eyes equally in striking contrast to acquired C.V.D. affecting one eye more than the other or one eye only. Most hereditary C.V.D. are constant in type and severity while acquired C/V/D vary in severity. While hereditary C.V.D. cannot be cured, a red filter has been found to be helpful to a number of patients. Acquired C.V.D. may be cured, with color vision often returning to normal after ocular pathology has been cured. It is suggested that color vision testing be given to all children at an early age, all patients on their first office visit, all patients with an undiagnosed low visual acuity, and all patients who report recent color disturbances or differences between the eyes. Several color vision tests (pseudo-isochromatic plates, Farnsworth-Munsell 100 Hue, Farnsworth D-15) are described. Most of the available pseudo-isochromatic tests do not provide for blue-yellow testing, and a specific battery is recommended to deal with this. Valid color vision testing requires control of the quantity and quality of lighting as well as time limitations. Monocular testing of color vision should replace the more traditional binocular method. Color vision testing is an important clinical tool that is often overlooked in clinical practice.

by Anthony J. Adams
Publ: Journal of the American Optometric Association v45 n1 p35-42 (Jan 1974)
1974; 25refs
Availability: See publication

HS-019 762

WINDSCREEN DIRT AND SURFACE DAMAGE EFFECTS

A study was conducted to obtain a population sample of automobile windshield surface damage and dirt accumulation, to evaluate the ability to see through the dirt and surface damage in a static and dynamic driving situation, and to evaluate the practicability of resurfacing automobile windshields. Measurements were made on 40 passenger cars varying in mileage, with and without windshield wipers. Most had been exposed to a significant degree to the abrasive dust created from the sand used for braking trams in Melbourne. All measurements were taken at night protected from light and direct rain but exposed to ambient outdoor temperature and normal humidity. All measurements were taken through the portion of the windshield judged to be most used by the driver looking at the highway straight ahead. The average veiling luminance index (0.75 at 5.3°) of the windshields sampled before washing was twice that of the average human eye (0.356). Half the windshields caused veiling glare from twice up to 7.7 times greater than that found in the human eye. Since ocular scatter increases with age, peering through the average windshield visually ages the driver and in many cases simulates a well-developed cataract. On the other hand, a new clean windshield contributes less than 5% as much veiling luminance as the average eye. The rubber used in the wipers needs improvement to reduce windshield damage. Techniques for hand cleaning in service stations may need to be improved. Windscreens can be satisfactorily resurfaced and should be (or else replaced) when they become damaged.

by M. J. Allen

Publ: Australian Journal of Optometry v58 n5 p180-9 (May 1975)

1975; 10rcfs

Reprinted from Australian Road Research v5 n6 (Dec 1974).

Availability: See publication

HS-019 763

WAXED WINDSHIELDS ARE HAZARDOUS IN THE RAIN

A study was undertaken to see if wax on a windshield as applied in a car wash causes a hazard in the rain. Seven cars were washed and waxed at four car washes. Photographic determinations were made of the glare produced by the wet or dry waxed windshield in a headlight beam. When wet, the waxed windshields scattered three times more light at 5° than the 40% normally expected in the human eye itself. Since some windshields when clean approximate zero scatter and others were no worse than 7.8%, the deterioration to 124% scatter in the rain is an extremely serious loss in transparency. Using the average clean, dry scatter of 5%, the scatter resulting from the wax and rain is 24.8 times higher. It is emphasized that these determinations were made with the windshields meticulously cleaned inside and out and with special care taken to avoid steaming up the inside of the windshield. Also, to be kept in mind is the fact that during the daytime there are an infinite number of light sources. The evidence of grossly increased glare from wax deposits on windshields and wiper blades leads to the conclusion that no wax residues should be permitted on the windshield and

wipers after a car wax. The National Highway Traffic Safety Administration (NHTSA) has already issued a Driver Alert.

by Merrill J. Allen; Donald W. Bennett

Publ: Journal of the American Optometric Association v46 n8 p823-6 (Aug 1975)

1975

Availability: See publication

HS-019 772

THE DESIGN AND PRESCRIPTION OF MULTIFOCAL LENSES FOR CIVIL PILOTS

The cockpit vision environment was analyzed in ten contemporary aircraft. Twenty-five pilots of seven of these aircraft types participated in a spectacle design study. Experimental spectacles were designed for each pilot and evaluated for performance. Problems of pilot acceptance of reading aids, custom designing to the geometry of a given aircraft, balancing of the visual gains from complex designs versus difficulties in use and manufacture were taken into consideration. Lens systems for pilots must be kept as simple as possible. Guidelines to lens types for pilots include Look-over Lens for incipient presbyopia; wide segment bifocal for distance and near correction; incipient presbyopia; Flitefocal Trifocal when the chart viewing distance is nearer than the forward instrument panel distance; and Double-D Trifocal should continue to eliminate all digits from the overhead instrument panel (should be located in forward instrument panel or pedestal) and overhead panel should contain switches with large, well-illuminated symbols.

by Howard A. Backman; F. Dow Smith

Publ: American Journal of Optometry and Physiological Optics v52 n9 p591-9 (Sep 1975)

1975; 17rcfs

Presented at the Annual Meeting of the American Acad. of Optometry, San Francisco, 11 Dec 1973.

Availability: See publication

HS-019 785

BINOCLAR LOW VISION TELESCOPIC SPECTACLES

Binocular low vision telescopic spectacles consist of a spectacle frame fitted with one or two telescopic systems, to which additional front lens power for near vision can be added. Principles underlying the design and use of these telescopic systems are presented. Advantages of binocular vision (over monocular vision) include better legibility and illumination. It is important to center the telescopes perfectly. Monocular and binocular telescopic spectacles for subnormal vision, microsurgery and other precision work using the new "mini" prism telescope 8x20 (Carl Zeiss, Germany) have been developed by the author. The new 6X prismatic telescope is compared with the Zeiss 1.8X telescope provided with a 6X lens cap. The visual field of the new 6X telescope is larger than that of the Zeiss 6X, viz 29 to 36 mm, but its peripheral sharpness is perfect and faultless, so that the new telescope can be used to its extreme periphery, independent of its magnification. The weights are practically equal, viz 37 grams. However, the diameter is 26 mm instead of 45 mm and the length is 55 mm instead of 32 mm. The brightness of any Galilean system (e.g. Zeiss 1.8X telescope) is always better than that of any prismatic system. The exit pupil of the new prismatic

illumination power. The Zeiss system can binocularly be employed up to 3X magnification at a 12 cm distance from the eye with difficulty in maintaining required convergence; the new system has a working distance of 25 cm or more which requires a very normal convergence. As opposed to Galilean systems, the prismatic telescopes do not show chromatic aberration; but a specially designed objective of about 30 diopters would improve the image sharpness.

by W. J. Biessels

Publ: Journal of the American Optometric Association v44 n12 p1238-43 (Dec 1973)
1973

Based on paper presented at the International Optical and Optometric Congress, Amsterdam, Jun 1971.

Availability: See publication

HS-019 814

SOFT (HYDROPHILIC) CONTACT LENSES IN U.S. ARMY AVIATION: AN INVESTIGATIVE STUDY OF THE BAUSCH AND LOMB SOFLENS

A study was conducted to evaluate the applicability of the Bausch and Lomb Soflens, a soft (hydrophilic) contact lens, to U.S. Army aviation. (The use of standard acrylic or hard contact lenses has been relatively unsuccessful in the military aviation environment when worn by personnel flying rotary wing aircraft.) Nineteen volunteer helicopter pilots served as subjects. Clinical procedures, foreign body involvement, and the effect of extended (72 hours) continuous wear were investigated. The results indicate that the Soflens offers certain advantages over acrylic lenses for this specialized application. Foreign body involvement has not been identified with their use, aviator response is very enthusiastic, clinical results and operational evaluation indicate that their use presents no insurmountable problems. Although the lens is not recommended for long-term (in excess of 18 hours/day), the probability of significant problems arising from an occasional overwear is rather remote. On the other hand, some problems encountered related to wearing of lens concern adverse changes in visual acuity if only transient, flight under stress that could result in decreased blink rate due to tendency to stare and thus increase probability of lens dehydration, and effect of temperature changes on lens. The Soflens cannot be recommended for across the board application to all ametropic U.S. Army aviators, but it is apparent that selected aviators could wear this lens comfortably and perform their work provided they receive professional care, have access to distilled water, and follow recommended wearing and cleansing procedures.

by John K. Crosley; Erwin G. Braun; Robert W. Bailey

Publ: American Journal of Optometry and Physiological Optics v51 n7 p470-7 (Jul 1974)
1974; 4refs

Presented at the Annual Meeting of the American Acad. of Optometry, San Francisco, 11 Dec 1973.

Availability: See publication

HS-019 826

RACIAL DIFFERENCES IN COLOR VISION: DO THEY EXIST?

An investigation of the possibility that variation in fundus pigmentation among individuals may be related to differential color sensitivity was conducted. Fifty black and white obser-

vation made direct heterochromatic brightness matches for a white standard field against each of five chromatic comparison fields. Results indicated that pigment (i.e. racial) differences in color vision do not exist, as measured by two psychophysical methods. The method of adjustment called for each practiced observer to perform several brightness matches as described above. The method of constant stimuli called for each practiced observer to state, for any given presentation of the white standard and colored comparison, whether the colored field appeared brighter or dimmer than the white field. The data showed that the heterochromatic matches were less reliable for the more saturated colors, violet and red, and also that the psychophysical methods used to obtain the matching data differentially influenced the results for the more saturated colors. The data from heterochromatic brightness-matching procedures showed an overall standard deviation of between 0.063 and 0.076 density unit, which amounts to not much more than the optical density of a pane of "clear" glass. It would appear from such reliability levels that more faith in this photometric technique may be justified.

by William O. Dwyer; Lain Stanton

Publ: American Journal of Optometry and Physiological Optics v52 n3 p224-9 (Mar 1975)
1975; 10refs

Availability: See publication

HS-019 844

MECHANISMS SUBSERVING SURFACE AND BORDER BRIGHTNESS CONTRAST

The relationship of mechanisms subserving surface contrast to border brightness contrast is studied. The mechanisms involved include retinal interaction, adaptation at the level of the bipolar in the retina and eye movements. Adaptation at the bipolar layer introduces a nonlinear relation between the photoreceptor response and the ganglion cell response. It also sets an upper limit to the response of the bipolar and were it not for eye movements the visual field would be reduced to a uniform brightness at high luminance levels. The eye movements prevent a difference in adaptation on the two sides of a border and thus provide for a difference in the response on the two sides of a border. Lateral inhibition has a greater spread than excitation and thus also accentuates the brightness at borders. A special frequency equalizing mechanism is postulated to explain the perceived uniformity of a surface between two borders. Surface contrast and border contrast involve the same mechanisms.

by Glenn A. Fry

Publ: American Journal of Optometry and Archives of American Academy of Optometry v50 n1 p17-33 (Jan 1973)
1973; 16refs

Availability: See publication

HS-019 859

PERIPHERAL VISUAL RESPONSE TIME AND RETINAL LUMINANCE-AREA RELATIONS

The stimulus luminance-area relations in the retina that underlie the peripheral visual response time (RT) were investigated. Button pressing response time was measured in five trained subjects to the onset of small visual stimuli imaged across the horizontal retinal meridian at 10 degree arc intervals from 90

degree are right to 90 are left of the line of sight. Four stimulus luminance conditions were presented at each peripheral retinal location, a low luminance condition (approximately 2.6 ft-L), a high luminance condition (approximately 22.2 ft-L), and two conditions in which luminance was varied systematically from low to moderately intense levels from one side of the visual field to the other. The two variable luminance conditions were included to see if it is possible to compensate for the progressive decrease in retinal stimulus image area caused by the apparent pupil. The results indicated that RT to stimuli imaged within approximately 70 degree arc from the fovea does not differ significantly when all possess about the same luminance. Mean RT is significantly faster to stimuli imaged beyond about 70 degree arc from the fovea when their luminance is increased by an amount equal to the foveal stimulus luminance multiplied by the cosine of the angle between the peripheral stimuli and the line of sight. This investigation has shown that binocular peripheral visual RT varies approximately linearly to brief, small photopic stimuli imaged across the entire horizontal meridian of the dark adapted eye. When the luminance of each stimulus is made progressively lower with increasing angular separation from the line of sight, however, the linear relationship only holds out to 60 degree arc from the line of sight. When the stimulus' luminance is made progressively higher with increasing angular separation from the line of sight, mean RT does not become correspondingly faster as might be expected.

by Richard F. Haines

Publ: American Journal of Optometry and Physiological Optics
v52 n2 p85-95 (Feb 1975)

1975; 39ref.

Availability: See publication

HS-019 862

THE HANDICAP OF COLOR BLINDNESS

The major kinds of color vision defects, handicaps in performance they might cause, and suggestions for counseling of persons with color vision abnormalities are discussed. Anomalous trichromasy is the condition in which a person uses different proportions than the normal observer of three primary colors to match every color he/she can see. Protanomalous trichromasy (protanomaly, red-weakness) is the condition in which a person sees more weakly any redness both in coloring power and brightness. Deuteranomalous trichromasy (deuteranomaly, green weakness) is the condition in which a person maladjusts the mixture control on the anomaloscope by adding more green (and subtracting some red). Dichromasy is the condition in which a person needs only two primaries to match every color in the spectrum. Dichromasy is subdivided into two groups, the first is protanopia (red blindness) where a person sees long-wavelength spectral colors (red, orange, and yellow for the normal) much reduced in brightness and learns to distinguish reds from yellows and greens on the basis of brightness not hue, and deuteranopia (green blindness) in which a person suffers hue discrimination problems as the protanope but without abnormal dimming of long-wavelength colors. The anomalous trichromat can usually pass as a normal observer in everyday activities while the dichromats cannot. When driving in dazzling sunlight or in rain or fog, a protanope may mistake a blinking red traffic light for a blinking amber one or fail to distinguish a green traffic from various "white" store or street lights. Other minor handicaps exist for the protanomalous person such as color in TV set, color of chemicals in lab, etc., and certain vocations (e.g. police work)

are closed to that individual. The deuteranomalous person suffers essentially the same handicaps (except reduction in brightness of green lights). Z-Chrom lenses or other monocular filtering devices may prove to be significant aids for achieving adequate color discrimination for tasks in everyday life. For adequate counseling of color-deficient patients, optometrists should first utilize tests that permit diagnosis of defect and its severity and then discuss problems associated with defect and provide ways to minimize the handicap.

by Gordon G. Heath

Publ: Journal of the American Optometric Association v45 n1
p62-9 (Jan 1974)

1974; 10ref.

Availability: See publication

HS-019 892

DRIVING WITH A BIOPTIC TELESCOPE: AN INTERDISCIPLINARY APPROACH

A discussion is presented of the criteria, the selection and fitting of the bioptic telescopic system for driving, and the coordination of the low-vision specialist and visual scientist in the training of low-vision patients for driving, thus using an interdisciplinary approach to solving the needs of the low-vision patient. The patient must have at least best corrected visual acuity of 20/40 on the Snellen chart and the field of view must be no less than 75° both nasally and temporally; must not have any serious color defects or large scotomas; must have good mobility and dexterity both physically and in the use of the bioptic telescope; and must be intelligent and highly motivated. The patient should receive a thorough low-vision evaluation (extensive case history especially to determine motivation for driving, trial frame refraction, measurement of visual acuities, extensive field study, color recognition). The training includes a discussion of problems of driving with a bioptic, performance and mastery of a sequence of tasks wearing the bioptic (locate stable objects while motionless, locate moving objects while motionless, develop visual discrimination and retention, execute above tasks while walking, execute above while riding as a passenger in a car); and actual behind-the-wheel driver training. In addition, a short outline of pertinent information was developed to be used for future reference. Six low-vision patients were fitted with bioptic telescopes, were given intensive coordinated training, and were able to fulfill the requirements of the Department of Motor Vehicles and were granted learner's permits. Five of the six obtained limited driver's licenses in California, the limitation being that driving was to be done during daylight hours. The one patient who did not receive a license failed to do so because of personal fears of driving once driving lessons were begun.

by Milton Levin; Dennis K. Kelleher

Publ: American Journal of Optometry and Physiological Optics
v52 n3 p200-6 (Mar 1975)

1975; 6ref.

Availability: See publication

HS-019 908

ERRORS IN SPACE PERCEPTION DUE TO ACCOMMODATIVE RETINAL ADVANCE

Accommodative retinal advance may be defined as the forward shift of the entire retina from contraction of the ciliary muscle in accommodation. The anterior border moves forward

0.5 mm at maximum accommodation, with an asymmetrical distortion of the image of space. It is as though the retinal image is projected on a thin sheet of rubber pulled out on three sides, the fourth being fixed by attachment to the optic nerve. Accommodative retinal advance explains some puzzling errors of space perception described in dozens of papers and monographs, usually attributed to unequal crowding of retinal receptors, or to mystical upper cerebral activity. The horopter error, the alley error, and the Aubert-Forerster phenomenon are discussed as consequences of accommodative retinal advance. Credit is given to those early experimenters whose theories have been confirmed. Hering's rule that a very definite direction in visual space corresponds to each point in the retina seems in need of modification. Innate retinal element direction value may be subject to retinal accommodative advance. It is possible that such direction value is subject to oculo-rotary muscle proprioception.

by Paul W. Miles

Publ: American Journal of Optometry and Physiological Optics v52 n9 p600-3 (Sep 1975)

1975; 15refs

Availability: See publication

HS-019 918

TELESCOPIC LENS SYSTEMS AND DRIVER LICENSING

A review of the literature related to low vision and use of the bioptic telescopic spectacle (BTS), and how they pertain to driver licensing standards, reveals a limited amount of material and a polarization in opinion. There has been very little effort through research, to determine if a low vision individual can become a safe driver with or without the low vision aid, with the exception of separate works by Korb and Feinbloom. Eight recommendations by the New York State Dept. of Motor Vehicles for the licensure of BTS wearers, as presented at a 1975 symposium sponsored by the Department, are as follows: individual must pass present static acuity test of 20/40 through the telescopic portion of the visual aid; must have a best corrected vision, through the carrier lens, of 20/160 or better; must have at least a 130° field of view with bioptic in place; must have a statement from a licensed practitioner as to the nature of the visual deficiency with a statement that condition is stable; must have a statement from practitioner that the individual has received competent training in use of BTS in a dynamic environment; must be able to pass a road test demonstrating skill in driving and coping with BTS; must submit to annual reexamination for vision and practical skills in a road test; and must have the device for a minimum period of time (probably two months). In evaluating the pertinent material available on the use of bioptic telescopic lens systems by drivers, the use of the visual aid as a substitute for good central acuity is established. As for limitations of the functional system, it is felt that the likelihood of an object being lost in the ring scotoma during pursuit or Saccadic fixations through the telescope is minimal and that there are no data on total visual performance of the low vision person (as well as for the general driving population) and, therefore, no basis for restricting BTS wearers on this account.

Safety Management Inst.

Contract C54385

1975?; 39p 22refs

Prepared for the New York State Dept. of Motor Vehicles.

Availability: New York State Dept. of Motor Vehicles.

Albany, N.Y. 12228

HS-019 920

A RATIONAL APPROACH TO LICENSE DRIVERS USING BIOPTIC TELESCOPES

The licensing of drivers with reduced vision who wear bioptic telescopic lenses is supported. The majority of the states have taken no position on the issue. The program now in effect in Florida, which is strictly reviewed and controlled by the Division of Drivers Licensing as well as a panel of physicians and optometrists, is proposed. In this program approximately 100 man years of driving have been logged, and the accident rate has approximated the average rate for the other drivers in the State of Florida. The following criteria are used in the Florida program to license drivers with bioptic lenses: must attain best corrected visual acuity of 20/100 in each eye with spectacles; must attain a corrected visual acuity through the bioptic portion of the lens of 20/40 in each eye; bioptic lens must be no more than 3.0X in power; bioptic housing must be coated black to reduce internal dispersion of light; candidates must have full and intact peripheral fields; no night driving; annual reexamination of individual's driving record; annual visual exam; candidate must need license in order to get to job, school, and doctor; biotics must be worn while driving; must be side view mirrors on both sides of car; and all applications for license must be submitted to a medical review board which includes a member who is knowledgeable in the area of low vision. If an application is approved, a four to six week adaptation period to use bioptic as spotting device, a 60-90 day period using prelearner's permit for driving under certain conditions, a standard written exam to receive regular learner's permit, and a more extensive road test than normal follow.

by Julian D. Newman

Publ: Journal of the American Optometric Association v47 n4 p510-3 (Apr 1976)

1976; 5refs

Availability: See publication

HS-019 933

VISUAL PERFORMANCE THROUGH A SAMPLE WINDSHIELD SEGMENT OF THE B-1 AIRCRAFT

The stereopsis performance of 16 subjects was measured on an automated Howard-Dolman apparatus and compared with their performance through a sample segment of a proposed B-1 aircraft windshield. Recognition visual acuity was determined for 15 subjects using a low-contrast Landolt C target viewed with and without the segment. When the task was performed through the windshield segment, a statistically significant loss in stereopsis resulted, but no significant loss in visual acuity.

by Wayne F. Provines; Benjamin Kislin

Publ: American Journal of Optometry and Physiological Optics v52 n1 p51-7 (Jan 1975)

1975; 10refs

Availability: See publication

HS-019 968

RESPONSE OF THE EYE TO A FLASH OF LIGHT

Mechanisms are postulated that deal with the response of the eye to a flash of light. A 1946 concept of the mechanisms involved in this response is referred to in building this new model. The bleaching of the photopigment by light and the

regeneration of photopigment constitutes the primary process. The mechanism called the secondary process is designed to explain bright and dark adaptation at ordinary levels of luminance. Positive afterimages involve a supplementary mechanism between the primary and secondary processes. The tertiary process which is similar to the first two is required to explain the rapid changes in adaptation which affect the response to sudden or rapid changes in the stimulus. The quaternary process involves a catalyst that transforms one substance to another, the first substance being maintained at a constant level in spite of the fact that part of it is being constantly transformed to the second substance. The second substance can be transported from the point at which it is generated to the point at which it produces impulses and then can be used up in the production of impulses. The gradual disappearance of this substance explains how a subthreshold flash of light fails to produce a response. Additional equations are derived for frequency of impulses generated by a steady stimulus, response to a steady stimulus, responses to short flashes superimposed on steady backgrounds, the brightness difference threshold, effect of the duration of a flash on the intensity required for the threshold, critical duration. The characteristics of these mechanisms have been derived from a study of such phenomena as the Blondel-Ray effect, Bloch's law, alpha and beta adaptation and the Broca-Sulzer effect. Consideration is also given to the measured responses of human photoreceptors and monkey cones to flashes of light.

by Glenn A. Fry
Publ: American Journal of Optometry and Archives of
American Academy of Optometry v50 n3 p355-75 (May 1973)
1973; 24 refs
Presented at the Annual Meeting of the American Acad. of
Optometry, New York, 17 Dec 1973.
Availability: See publication

HS-019 972

VISION AND TRANSPORTATION. A BIBLIOGRAPHY ON THE VISUAL ASPECTS OF HIGHWAY AND AIR TRAVEL

A bibliography of 282 items dealing with various aspects of vision and highway and air travel is presented. Items which are concerned with aviation are identified throughout the bibliography, as are books and pamphlets available from the International Library, Archives and Museum of Optometry.

American Optometric Assoc., 7000 Chippewa St., St. Louis,
Mo. 63119
1976; 18p
Availability: Corporate author

HS-019 973

THE HUMAN THORAX--ANATOMY, INJURY, AND BIOMECHANICS

Materials for a short course include five papers on human chest anatomy, blunt trauma and frontal loading, and frontal and lateral thoracic injury.

Society of Automotive Engineers, Inc., 400 Commonwealth
Drive, Warrendale, Pa. 15096
Rept. No. SAE-P-67; 1976; 86p
A Continuing Engineering Education Course developed by
SAE Automobile Body Activity--Passenger Protection Com.,
Dearborn, 20 Oct 1976. Includes HS-019 974--HS-019 978.
Availability: SAE

HS-019 974

THE ANATOMY OF THE HUMAN CHEST

The major anatomical features of the human chest are briefly described in text and illustration. The chest or thoracic region is the upper part of the torso which extends from the base of the neck to the lower rib margin above the soft belly wall. The bony thorax is comprised of the sternum, 12 pairs of ribs, and the 12 thoracic vertebrae. The interior of the thoracic area is divided into three regions known as the thoracic cavities. The right and left pleural cavities are the spaces for the right and left lungs. The mediastinum contains the heart and great vessels, the trachea, esophagus, nerves, and other blood vessels. Thoracic respiration is described. Traumatic respiratory problems include "fail" chest (minimal lung expansion during breathing), hemothorax or free blood in the pleural cavity, pneumothorax or free lung air in the cavity, or a combination called hemopneumothorax. All may be caused by rib fractures. The function of the largest structure contained within the mediastinum, the heart, is described. Traumatic injury to the heart may be in the form of a tear in the wall causing a cardiac tamponade or minimal pumping action, or a rupture of the aorta (commonly at the junction of the aortic arch and the descending thoracic aorta). The least frequently traumatized structures in the thorax are the azygos veins and the thoracic duct.

by Donald F. Huelke
University of Michigan Medical School, Dept. of Anatomy
Publ: HS-019 973 (SAE-P-67), "The Human Thorax--Anatomy,
Injury, and Biomechanics," Warrendale, 1976 p1-9
1976
Availability: In HS-019 973

HS-019 975

AN INTRODUCTION TO THE UNDERSTANDING OF BLUNT CHEST TRAUMA

An attempt is made to provide a working knowledge of the function of the respiratory and circulatory systems and to show how injury to each or both can lead to life threatening changes in function. It also shows how various components of the human thorax respond to impact, and outlines the diagnosis and treatment of the resulting injuries. The function of the respiratory system is briefly treated. A description of the gas transport system is supplied, and the physicochemical processes involved in transport are discussed. The position and bony protection of the major organs of the thoracic cavity, the lungs, heart, and esophagus are discussed. The function of the respiratory system and the position of the various organs in relationship to the ribs is treated textually and illustratively. A detailed description of the various processes involved in pulmonary ventilation is provided. The types, mechanisms, effects, and management of blunt chest trauma comprise part two of the paper. Several terms are defined in connection with this type of injury. Hypoxemia exists when there is a reduction from normal in the oxygen content of the arterial blood. Hypoxia is a condition where there is a decrease in the amount of oxygen available to the tissues in relation to the demands. Anemic hypoxia is not seen in trauma states unless the patient suffered a preexisting anemic disorder or the blood has been replaced. Tissues receive insufficient oxygen because the hemoglobin content is low and both the oxygen and oxygen carrying capacity of the blood are lower than normal. Histotoxic hypoxia is seldom encountered in trauma states. In this condition, toxic substances, such as cyanide, poison the

intracellular enzymes thus interfering with the ability of tissue cells to utilize oxygen delivered to them. The acute respiratory distress syndrome (ARDS) is outlined. Some complications of rib fracture are lung collapse (atelectasis) and tension pneumothorax. The principal malfunctions involved in the flail chest injury are presented. Complete detachment of a segment of chest wall allows it to suck inward on inspiration, instead of outward with the remaining chest wall, and move outward on expiration. Inward movement on inspiration dissipates the negative intrapleural pressure so that little or no air moves into the involved lung, causing a large amount of wasted muscular effort, and the retention of lung secretions. Stabilization of the thoracic skeleton, restoration of lung and blood volume are necessary for treatment. Diaphragmatic injuries such as right sided ruptures in the form of peripheral avulsions from the costal attachment are described. Esophageal injuries such as lower esophageal tears exposing the chest cavity to air at atmospheric pressure are also treated. Injuries to the major intrathoracic airways are rare in accident victims. These usually show up in the form of lacerations near the bifurcation of the trachea (carina), and tears of the main stem bronchi. The heart's response to blunt chest trauma includes subepicardial and subendocardial hemorrhages, and frank rupture of the cardiac chambers. Myocardial contusion, ruptures of valvular components, pericardial tears, rupture of the various chambers, septal ruptures, and injuries to the coronary vessels are specific injuries documented. Injuries to the thoracic aorta usually take the form of ruptures or tears of the vessel wall. Diagrams and X-rays illustrate the functions of and injuries to the organs discussed.

by G. William N. Mulligan; Gordon S. Pizey; Douglas Lane; Lars Andersson; Chris English; Caroline Kohut
University of Manitoba
Publ: HS-019 973 (SAE-P-67). "The Human Thorax--Anatomy, Injury, and Biomechanics," Warrendale, 1976 p11-36
1976; 71refs
Availability: In HS-019 973

HS-019 976

FRONTAL FORCE IMPACT TOLERANCE OF THE HUMAN THORAX

The impact tolerances of the areas of the human thorax which are subject to injury in frontal force impacts are described. The sternum at the anterior termination of ribs one to seven is one often injured area. The thoracic spine which consists of 12 vertebrae is an important part of the thorax which is injured less often than the ribs, but which when injured often results in more serious injury such as paraplegia or quadriplegia. Injuries to the thoracic spine are generally produced by bending, compression, and combinations of bending and compression. The clavicles are of particular interest since their location makes them prone to impact loading and injury from shoulder belt, A-post, and steering wheel rim. Ribs are the most vulnerable torso skeletal component in frontal force automobile accidents. Several test results are cited which show that rib fractures are the most common accident injury. The types of loading on the thorax in frontal force automobile accidents are described. Loading can be uniform, concentrated, crushing, and combinations of these types. Concentrated forces cause damage to individual ribs or small areas of soft tissue. Crushing occurs occasionally from gross deformation of the vehicle or from loading of front seat occupants by rear seat occupants. Human thorax impact tolerance is defined as the quantitative response to impact of the thorax corresponding to a predetermined degree of injury in an average individual. Vari-

ous levels of impact tolerance that have been considered are discussed, and the many variables affecting tolerance are provided. Parameters used to describe impact conditions and/or tolerance include the variables of age, sex, size, physical condition, and type of exposure. Tolerance is presented as the tolerance of the average individual with the likelihood of injury estimated. The unrestrained occupant represents the condition with the maximum number of variables in forward force automobile accidents, and so injuries can be approached statistically. Discussion of restrained occupants is divided into sections by the type of restraint. Tests have shown that lap and lap and shoulder belts are effective in reducing overall injury at the abbreviated injury scale two (AIS) and greater level. The discussion of tolerance levels is limited to individual exposure conditions. The primary conditions considered for frontal force collisions are: accident investigation results; laboratory tests with chest impact by a moving impactor; laboratory data under simulated collision conditions; and combined accident investigation and laboratory data. In the automobile collision environment, there is little applicable tolerance data for unrestrained occupants since the area, direction, and magnitude of force applied to the torso in a collision cannot be anticipated. Test results have yielded limited data on tolerance of the human thorax.

by L. M. Patrick
Wayne State Univ., Biomechanics Res. Center
Publ: HS-019 973 (SAE-P-67). "The Human Thorax--Anatomy, Injury, and Biomechanics," Warrendale, 1976 p37-48
1976; 34refs
Availability: In HS-019 973

HS-019 977

THORACIC RESPONSE TO BLUNT FRONTAL LOADING

"Response" as used is defined to include both mechanical response, in terms of force, acceleration, and deflection characteristics under loading, and trauma response in terms of types and severity of resulting injury. A basically chronological account is presented of the General Motors Research Laboratories (GMR) thoracic loading studies since their inception in 1963 up to a recent investigation of skeletal acceleration response to impact and the development of a recommended multiparameter thoracic injury prediction criterion. Pertinent work of other investigators, such as Stalnaker, et al and Roberts, et al, and certain of the GMR studies not already treated earlier, are presented. Studies were conducted involving volunteers, human cadavers, anesthetized and postmortem subhuman primates, and "in vivo" canine and porcine subjects. The initial GMR thoracic loading studies were carried out in eight phases, using anatomically embalmed cadavers, during the period from 1963 to 1967. In these experiments, impact loading of the thorax was accomplished as part of a test protocol which also included dynamic loading of the knees and head during full scale simulated collision tests. Injury response from these first impactor experiments was assessed only on the basis of skeletal damage, but the results implicated thoracic deflection as a correlating factor with trauma. Time histories of applied force, resulting deflection, and skeletal acceleration were measured, and associated force versus deflection response characteristics were determined. Trauma response was revealed by postexposure necropsies. There is strong confirming evidence that, for a fairly broad spectrum of impact conditions, thoracic dynamic force-deflection response is, in general, characterized by a sharply rising force followed

April 30, 1977

by a plateau sustained to near maximum deflection and a rather abrupt terminal load decline.

by Charles K. Kroell
General Motors Corp., Biomedical Science Dept.
Publ: HS-019 973 (SAE-P-67), "The Human Thorax--Anatomy, Injury, and Biomechanics," Warrendale, 1976 p49-77
276refs
Availability: In HS-019 973

HS-019 978

BIOMECHANICS OF LATERAL THORACIC INJURY

The characteristics of the automotive occupant side impact problem and the biomechanical factors involved in lateral impact response and injury in the human thorax are discussed. The major problems connected with protection of vehicle occupants sitting on the near side of a vehicle subjected to a side impact are listed: minimal crush distance to attenuate and control the forces of the crash; penetration of the occupant compartment space; partial ejection of the occupant through the side windows; and difficulty of adequate lateral restraint of the occupant by conventional restraint systems. Accident investigations have shown that one of the most common types of life-threatening injuries in side impact accidents are chest injuries. In contrast to studies of impact tolerance involving vertical, forward, or rearward-facing body orientations, few studies have been conducted with either human or animal subjects facing sideward. Primarily, animal tests have been conducted relative to aerospace programs. Robinson, et al and Stapp have carried out tests on monkeys and chimpanzees, respectively. Lateral impacts tests have been conducted on 64 Air Force volunteers protected by various military aircraft and spacecraft restraint systems at up to 18.7 sled G at 20 feet per second entrance velocity, without significant injury. Analysis of the involvement of the thoracic organs in the physiological responses produced in the studies indicate that the pulmonary and cardiovascular systems are the most critical elements in determining the tolerance of the human thorax to lateral acceleration. Whole body side impact tests are being conducted at the Highway Safety Research Institute (HSRI) and are utilizing unembalmed human cadavers and anesthetized baboons. An important finding of the tests to date has been the occurrence of significantly higher vascular pressure peaks in lateral impact than in comparable frontal impacts. The biomechanics of local thoracic lateral impact are discussed. An alternative method to whole body lateral impact is that of localized impacts directly to the stationary thorax of animals and human cadavers using a pneumatically operated testing machine specially constructed for impact studies. Typical injuries observed in the series of monkey impacts are presented in table form. Petechial hemorrhage of the lung and occasional tears to the lung were seen most frequently. Ruptures of the heart were found in two cases. Cadaver tests showed that age of the test subject greatly influenced occurrence of rib fracture upon impact. An attempt was made to relate the injury ratings developed in the lower primate tests to the human cadaver response data obtained using thoracic injury scaling data. Chest displacement was chosen as the parameter for evaluating chest injuries because most chest injuries were found to be related to deflections of the rib cage.

by J. W. Melvin

HS-019 981

HS-019 979

MATHEMATICAL MODELING. BIODYNAMIC RESPONSE TO IMPACT

Nine papers on mathematical modeling in biodynamics deal with skull and femur fracture; models for the head, neck, neuromuscular cervical spine, and spinal column; using thoracic impact data to derive models; effectiveness of models as human analogs; stability in traffic accident reconstruction; and the SMAC and CRASH computer programs.

Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pa. 15096
Rept. No. SAE-SP-412; 1976; 97p
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.
Includes HS-019 980--HS-019 988.
Availability: SAE

HS-019 980

A MATHEMATICAL MODEL TO PREDICT SKULL FRACTURE UNDER IMPACT LOADS

The significant correlation of skull fracture with fatal head injury suggests such fracture prevention to be a useful minimal design criterion. A spherical cap under dynamic load loading is recommended as an effective mathematical model to assess skull fracture. With finite difference techniques in space and time, the governing large deformation cup equations are solved for a circular load area. For load pulses of practical significance, the only parameters of concern are load area, load amplitude, skull thickness, and maximum allowable stress. Curves are presented of fracture load with load area for various skull thicknesses. Results suggest that increasing the load area greatly diminishes the possibility of fracture. Hence, helmet and vehicle designers should aim towards this end. To assess brain damage, a much more general mathematical model must be developed, one which could predict brain motion during impact, as illustrated by Hodgson and his colleagues in experiments with primates wearing transparent cranial caps. It was determined that the sharp orbital ridges behind the eyes are hazard points for the brain under impact conditions. A series of autopsies made in Japan confirmed this determination. Precise mathematical models for predicting brain damage may be possible when brain motion models are coordinated with simulation models.

by Nicholas Perrone
Office of Naval Res.; Catholic Univ., Engineering School
Publ: HS-019 979 (SP-412), "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p1-8
Rept. No. SAE-760768; 1976; 36refs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.
Availability: In HS-019 979

HS-019 981

THREE DIMENSIONAL MODEL OF THE HUMAN HEAD AND NECK FOR AUTOMOBILE CRASHES

A comprehensive three-dimensional model of the human head and neck is presented, allowing for the possibility of six

placements, velocities, and accelerations of the head and neck resulting from contact and/or inertial impact forces. Key anatomical components are incorporated in this model along with a joint stopping mechanism. Known acceleration profiles are input to the torso and/or head force time histories are specified. The equations of motion are then derived using d'Alembert's form of Lagrange's Principle and are numerically integrated using a fourth order Runge-Kutta technique. Validation is accomplished by the comparison of responses from direct frontal and occipital impact experiments on human cadavers, and sled tests conducted on human volunteers. The model head's center of gravity, acceleration, velocities, and displacements agreed well with experimental data for both impact and inertial loads. The advantages of the model lie in its three-dimensional adaptability to all modes of impact, and to its scaling ability to accommodate different anthropomorphic sizes. It is also repeatable and economical in terms of computer time. Future areas of study include validation of the model in the temporal and oblique planes; investigation of the interaction with headrests, windshield, dashboard, and airbags and of multiple impact loading; development of separate brain model segments to predict relative motion and shearing stresses between the cerebellum, spinal cord, lobes and the skull; investigation of instantaneous center, force transmissibility and moment transmissibility; and the evaluation of helmet-head-neck response.

by Jeffrey C. Huston; Sunder H. Advani
Iowa State Univ., Dept. of Engineering Science and Mechanics; West Virginia Univ., Dept. of Mechanical Engineering and Mechanics
Publ: HS-019 979 (SP-412); "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p9-20
Rept. No. SAE-760769; 1976; 13refs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.
Availability: In HS-019 979

HS-019 982

NEUROMUSCULAR CERVICAL SPINE MODEL FOR WHIPLASH

A computer model of the neuromusculature and passive elements of the cervical spine during whiplash indicates that the neuromusculature increases the rotational stability of the cervical spine during low level accelerations. This results in decreased bending but increased axial compressive stresses in the passive structures and increased axial tensile stresses in the neuromusculature. Increased neural feedback augments peak acceleration and stress because the "active" neuromusculature causes a flexion response near the end of the acceleration pulse. A decrease in neural delay time allows the muscles to act earlier and decrease peak accelerations and bending stresses.

by U. R. Pontius; Y. K. Liu
Tulane Univ. Medical School, Biomechanics Lab.
Publ: HS-019 979 (SP-412); "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p21-30
Rept. No. SAE-760770; 1976; 18refs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.
Availability: In HS-019 979

HS-019 983

A BIODYNAMIC MODEL OF THE HUMAN SPINAL COLUMN

A biodynamic model of the spine simulated the action spinal musculature on the head, vertebral bodies, and pelvis the midsagittal plane. Muscle was treated as a force generator whose contractile force was dependent on muscle stretch rate, and neural delay time. Eight model runs were conducted with and without muscle, simulating 0Gz and impact acceleration. Three different impact situations were represented: short duration and relatively low peak acceleration, to simulate "pancaking" type aircraft or helicopter crew (lap belt only); longer duration acceleration, simulating pilots on an ejection training tower (lap and shoulder belt); and negative gravity impact acceleration (shoulder and belt). The model predicted that spinal musculature was incapable of affecting overall spinal column kinematics. However, a result of muscle contraction, significantly higher local forces were predicted in the discs and facets than were predicted when muscle was absent. The predictions of this model could have important implications in cervical injuries resulting from such events as parachute opening shock, air "ditching" into the ocean, and "head-spearing" football tackle. In future spinal models, careful consideration should be given to the cervical region, particularly the unique configuration of the first and second cervical vertebrae, with inclusion of anterior musculature. Analysis of relative motions of 1 vertebrae and determination of maximum shearing and bending moments would be useful criteria in predicting injuries.

by S. A. Tennyson; A. J. King
Wayne State Univ., Biomechanics Res. Center
Publ: HS-019 979 (SP-412); "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p31-44
Rept. No. SAE-760771; 1976; 28refs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.
Availability: In HS-019 979

HS-019 984

IDENTIFICATION OF MATHEMATICAL MODELS FROM IMPACT DATA: APPLICATION TO THORACIC IMPACT

A general method is presented for deriving the parameter mathematical models from impact data. It is suggested that the model should be no more complex than the detail of experimental data available to verify it. An error measure between the model and the experimental data is proposed which, with repeated simulations of model response. This error measure formulated for a simple model of the chest utilizing the data of Kroell, et al., which was obtained from cadaver tests. The error is minimized by using both gradient and nongradient minimization techniques to obtain model parameters. A reasonable correlation between model and experiment indicated that the method proposed may be a useful tool for researchers attempting to tune mathematical models to experimental data.

by Joseph C. Free; James W. Hall; Cesar A. Montano
Brigham Young Univ., Dept. of Mechanical Engineering
Publ: HS-019 979 (SP-412); "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p45-51
Rept. No. SAE-760772; 1976; 7refs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.
Availability: In HS-019 979

HS-019 985

INVESTIGATION OF IMPACT RESPONSE AND FRACTURE OF THE HUMAN FEMUR BY FINITE ELEMENT MODELING

The mechanical response of a plane strain finite element model depicting an axial midsection of a human femur is investigated for both static and dynamic condylar loadings. An elastic bi-medium structure composed of compact and cancellous bone is used to represent the femur. Static femur responses are analyzed for lateral, medial, or combined condylar loads and estimates made of static load levels necessary to produce critical stresses within the femur. Inclined impact loads could be expected generally to produce femoral fracture at lower load levels for a restrained femur. Average peak dynamic response characteristic curves are developed for critical compact and cancellous bone location. Temporal response curves are used to develop normalized fracture characteristic curves which are a function of the load duration. An analysis of available experimental data is made from cadaver knee impacts to obtain average femoral fracture and nonfracture load levels and associated load time durations. There is an increasing average peak fracture force as the load duration decreases. Average fracture loads and pulse durations from the experimental data are superposed on the developed fracture load characteristic curves. An analysis is made of strain rate effects (increased strain rates are reported to increase the fracture stress level for compact femoral bone) to obtain a cumulative fracture load characteristic curve. Critically stressed locations are identified and associated static and dynamic load levels which may initiate femur fracture are calculated. The predicted fracture sites and load levels are found to be in good agreement with published data for cadaver knee impacts. An important conclusion of this investigation is that the peak stress or strain and therefore femoral tolerance significantly depends on the impact duration due to stimulation of structural resonances.

by David C. Viano; Tawfik B. Khalil
General Motors Corp., Biomedical Science Dept.
Publ: HS-019 979 (SP-412), "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p53-60 Rept. No. SAE-760773; 1976; 14rcfs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976. Availability: In HS-019 979

HS-019 986

THE EFFECTIVENESS OF MATHEMATICAL MODELS AS A HUMAN ANALOG

Data on the dynamic response of the living human head and neck to -Gx impact acceleration are analyzed. The Calspan "3D Computer Simulator of a Motor Vehicle Crash Victim," Ultrasystems "Crash Victim Simulator - Light Aircraft" and Boeing Computer Services "Prometheus" were used to provide estimates of the responses monitored. Inputs to the programs were made as comparable as program restrictions would allow. Outputs were compared to each other as well as to the corresponding human test run. Program outputs proved to be consistent but failed to adequately replicate human results. Inclusion of head to neck articulation did not by itself improve results. Relocation of the head pivot away from the occipital condyles or introduction of muscular activity was indicated. Inter-program correlations could be improved by further adjustments to the input parameters, but this would not improve

correlation with test results. Possible improvements to increase sensitivity include greater sophistication in modeling occupant environment interactions, such as with seating and restraint systems, and as the result of submarining and contacts with cabin surfaces. Relatively small errors in joint ranges, in loading and unloading properties, and in force deformation characteristics of the interacting surfaces can significantly change results.

by Georg D. Frisch; Joseph O'Rourke; Louis D'Aulerio
Naval Air Devel. Center, Crew Systems Dept.
Publ: HS-019 979 (SP-412), "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p61-73 Rept. No. SAE-760774; 1976; 16rcfs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976. Availability: In HS-019 979

HS-019 987

STABILITY CONSIDERATIONS IN THE MATHEMATICAL RECONSTRUCTION OF TRAFFIC ACCIDENTS

Computerized simulations of traffic accidents are done for research and for reconstruction purposes. Motions of several interacting bodies, however, are prone to be highly instable. Meaningless results can therefore be produced. Two methods are introduced which allow for an assessment of the stability of a motion. The results obtained seem to support the hypothesis that all accident motions are instable to some degree. In each accident situation to be simulated or reconstructed on a computer it has therefore to be decided whether the appearing instabilities are tolerable or not. Two field examples are discussed in which a car hit more than one pedestrian simultaneously. The first case exhibits a tolerable and the second case an intolerable instability. In each case the injury patterns of the victims are very similar because of the similar impact.

by Peter Niederer; Felix Walz
Swiss Federal Inst. of Tech., Inst. for Biomedical Engineering; Univ. of Zurich, Inst. for Forensic Medicine
Publ: HS-019 979 (SP-412), "Mathematical Modeling. Biodynamic Response to Impact," Warrendale, 1976 p75-84 Rept. No. SAE-760775; 1976; 7rcfs
Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976. Availability: In HS-019 979

HS-019 988

COMPUTER AIDS FOR ACCIDENT INVESTIGATION

The Simulation Model of Automobile Collisions (SMAC) and Calspan Reconstruction of Accident Speeds on the Highway (CRASH) computer programs have been developed with the objective of providing aids for interpretation of physical evidence. Through the use of such aids in accident studies, it is possible to establish injury thresholds and mechanisms for living humans in relatively detailed exposures and under different conditions of restraint and protection. In addition to providing refined measures of the performance of protective devices, such studies can provide an improved basis for evaluation of test devices (i.e., anthropomorphic dummies and other surrogate crash victims). The existing forms and the evidence requirements of the SMAC and CRASH programs are described, and results of pilot application studies are

presented and discussed. Since the present application experience is quite limited the conclusions to be drawn regarding definition of injury thresholds are not extensive. During 1976 a number of more extensive accident studies using CRASH will be performed. With a larger number of data points, it is anticipated that the threshold boundaries for different injury levels will be better defined. When plots can be prepared for given seating positions, and for conditions of restraint and vehicle sizes, the amount of scatter will diminish. Presently both SMAC and CRASH are limited to flat-surface collisions and do not include complicated factors such as secondary collisions with roadside obstacles, effects of terrain, and rollovers. The SMAC program costs approximately \$20 per run; the CRASH program, \$2.50 per run. In future development the distinction between needs of a "production" type program and those of a developmental prototype must be recognized. The limited application experience to date has established the feasibility of achieving uniform interpretations of physical evidence in large-scale accident studies through use of CRASH. Validation of the computer program must be extended. Development and validation of SMAC should be continued for use as a research tool for accident cases of special interest and for providing a high-fidelity reference for evaluating analytical extensions in the CRASH program. An Appendix provides discussion and analysis of the effect of speed changes on the extent of damage.

by Raymond R. McHenry

Calspan Corp., Transportation Res. Dept.

Publ: HS-019 979 (SP-412), "Mathematical Modeling.

Biodynamic Response to Impact," Warendale, 1976 p85-96

Repts. No. SAE-760776; 1976; 17 refs

Presented at the 1976 SAE National Automobile Engineering and Manufacturing Meeting, Dearborn, Mich., 18-22 Oct 1976.

Availability: In HS-019 979

HS-019 989

STATISTICAL ASPECTS OF INJURY SEVERITY. PT. 1: COMPARISON OF TWO POPULATIONS WHEN THERE ARE SEVERAL GRADES OF INJURY

A method of comparing the average levels of injury sustained in traffic accidents of two populations consists of plotting the proportion of cases in one population that exceed an arbitrary threshold of severity against the proportion of cases in the other population that exceed the same threshold, as the threshold varies. The further this curve is from the 45° line, the greater is the difference in severity between the populations. The precise shape of the curve depends on the particular model considered: two examples are derived from considering the distributions of injury severity, respectively, each to be normally distributed with the same variance, or exponentially distributed; the means of the distributions differing. Applications of this method are described and include the following. An objective assessment can be made of changes in injury severity with injuries classified into several groups in the two conditions by constructing an empirical relative injury frequency (RIF) curve and estimating the parameter of the type of curve selected. Prediction can be made of effectiveness of injury reduction measure in one country from knowledge of its effect elsewhere. The initial level of injury severity can be compensated for when comparing effectiveness of injury reduction in two circumstances. Estimates of reduction can be made in fatalities in small samples where only serious and slight injuries can be accurately estimated. Missing data can be

estimated, errors can be compensated for, and change in classification of injury can be analyzed.

by T. P. Hutchinson

Publ: Transportation Science v10 n3 p269-84 (Aug 1976)

1976; 1 ref

Pt. 2 is HS-019 990.

Availability: See publication

HS-019 990

STATISTICAL ASPECTS OF INJURY SEVERITY. PT. 2: THE CASE OF SEVERAL POPULATIONS BUT ONLY THREE GRADES OF INJURY

The quantification of the correlation that in certain traffic accidents where a high proportion of persons are killed, there are usually a high proportion of persons seriously injured, is considered. If the result of changing from category to category on one factor is to change one parameter of the distribution of injury severity (e.g., the mean level of a normal distribution), then by plotting the proportion of cases seriously injured against the proportion killed, with the different points corresponding to the different categories of the factor, the shape of the RIF (relative injury frequency) curve can be deduced. In particular, it was found (using British data) that the variation in injury severity in a number of situations can be described by alterations in the exponent of an exponential distribution of severity, with the boundary between slight and serious injury occurring at one-third the distance from the origin of the boundary between serious and fatal injury.

by T. P. Hutchinson

Publ: Transportation Science v10 n3 p285-99 (Aug 1976)

1976; 1 ref

Pt. 1 is HS-019 989.

Availability: See publication

HS-019 991

AN EXPERIMENTAL STUDY OF PACKAGE CUSHIONING FOR THE HUMAN HEAD

An experiment was performed to determine the container acceleration and pressure distribution in a Plexiglass cylinder, filled either with water or 3% set-gelatin, and impacted against a wall. This experiment serves to quantitatively validate a theoretical model simulating a one-dimensional closed-head impact given earlier. The experiments showed important differences between the theoretical and experimental pressure measurements. When the medium contained within the cylinder was water, the coup pressure, as found by experiment, was higher than the mathematical model prediction, while the contrecoup pressure was in good agreement. When the container was filled with set gel, the coup pressure was in agreement with the mathematical model, but the contrecoup pressure was considerably lower than the calculated result. Since the brain is neither water nor gel, in vivo animal experiments are needed to obtain meaningful tolerance limits for injury due to cavitation at the contrecoup region in closed-head impacts.

by Y. King Liu; K. B. Chandran

Publ: Journal of Applied Mechanics v43 Series E n3 p469-74

(Sep 1976)

1976; 16 refs

Presented at ASME Meeting, Biomechanics Symposium, Troy,

ANALYSIS OF ELASTIC-PLASTIC IMPACT INVOLVING SEVERE DISTORTIONS

A Lagrangian analysis technique has been formulated for two-dimensional axisymmetric impact problems involving elastic-plastic flow. This technique is based on triangular finite element formulation rather than the quadrilateral formulation generally used in comparable finite difference methods. For impact problems involving severe distortions, the triangular element formulation is better suited to represent the severe distortions than is the traditional quadrilateral finite difference method. A computer program, EPIC, is developed; two examples are presented to illustrate the technique, one involving a nickel cylinder impacting an aluminum plate at 1500 m/s, the other a nickel sphere impacting an aluminum plate also at 1500 m/s. By using elements of triangular cross section, this method can provide Lagrangian solutions for impact problems involving very severe distortions.

by G. R. Johnson

Publ: Journal of Applied Mechanics v43 Ser E n3 p439-44 (Sep 1976)

1976; 12refs

Availability: See publication

HS-019-993

EMERGENCY CONTROL OF VEHICLE PLATOONS: CONTROL OF FOLLOWING-LAW VEHICLES. SYSTEM OPERATION AND PLATOON LEADER CONTROL

The dynamics of platoon following law vehicles under longitudinal control are presented, and an automatic control concept is developed for both normal and emergency longitudinal regulation of high density strings of vehicles with velocities in the range of 50 to 90 mph (80 to 144 km/hr). Because controller gains selected for normal operation give inadequate performance in emergency operation, dangerous spacing in platoons moving at lower than design speed and delayed target velocity update effects were investigated. It was found that stability of the vehicle system in emergency operation is related to controller gains. Simulations for various emergency contingencies are therefore presented. Under the automatic control concept, a vehicle string is formed into platoons of vehicles, the lead vehicles of which are governed by wayside-mounted controllers. Excluding platoon leaders, vehicles are controlled by onboard controllers, termed car-following or following-law controllers, which continuously regulate vehicle spacing and velocity with respect to an external, desired velocity. Wayside controllers, which communicate with vehicles only when they cross discrete control points along the guideway, provide "modified block control" of lead vehicles, maintaining a safe stopping distance so that collisions under an instantaneous stop cannot occur between vehicles of separate platoons. The proposed control appears suitable for realistic guideway conditions and provides flexibility in performance tradeoffs among wayside hardware, safety, nominal guideway line speed, and guideway vehicle capacity. Spaces generated between platoons under normal operation afford capability for merging from off-line queues.

by R. J. Rouse, Jr.; L. L. Hoberock

Publ: Journal of Dynamic Systems, Measurement and Control v98 Series G n3 p239-51 (Sep 1976)

1976; 30refs

Availability: See publication

APPLICATION OF COMMERCIAL RADIO TO FREEWAY COMMUNICATIONS - A STUDY OF DRIVER ATTITUDES

To broaden the application of real-time freeway operations systems, a questionnaire survey was administered to 505 motorists, 327 from Houston and 178 from Dallas, selected at random from employees of several organizations in those two cities. The questionnaire sought information on whether knowledge about freeway traffic conditions would be helpful, how such information should be received (radio, signs, television, or telephone), and where (on the major street, at the entrance ramps, at the beginning of the trip, or on the freeway). The following information was obtained. Motorists expressed a willingness to divert to an alternate arterial street if they had knowledge of an unusual condition on the freeway and provided that a suitable alternate route were available. They would prefer to divert before entering the freeway rather than after being on the freeway. Forty-seven percent indicated they would always use such information to plan trips if the information were accurate; 38% responded they would make frequent use of such information. Ranking of preference for how to receive traffic information was based on Kendall's Coefficient of Concordance, and the following preferences were shown in order of most to least desirable: radio, signs, television, and telephone. Further evaluation of results indicated no appreciable difference between preference for radio and preference for signs. Of those who had car radios, 62% currently use radio traffic bulletins for trip planning during the peak period, and 89% indicated they normally listen to the car radio. Motorists expressed preferences for receiving information about freeway traffic conditions before they enter the freeway and at locations where decisions can be made with respect to the selection of alternate routes. Analysis of first choice preferences revealed that 42% considered information at the beginning of the trip to be their highest preference, 34% chose on the major street as first preference, 16% chose entrance ramps, and 8% preferred information on the freeway. A relationship was found between the preference of communication mode and the preference for receiving information at the beginning of the trip. Those who ranked radio as the preferred mode of receiving traffic information placed high emphasis on receiving information at the beginning of the trip and on major streets. Little difference was found between responses of motorists in the two cities. Since one specific objective of the project was to investigate the application of commercial radio to freeway communications, the questionnaire information led to the following conclusions. Commercial radio should be further developed as an integral part of a real-time traffic information system for urban freeways. Alternatives for radio use include providing information to the radio stations directly from a freeway surveillance and control center and allowing the station to decide when to broadcast the information; buying prime radio time during the peak periods and providing such information as a public service; acquiring a separate frequency to broadcast during the peak periods; and using induction radio systems that broadcast over any existing station on car radio.

by Conrad L. Dudek; Dannie Cummings

Texas A and M Univ., Texas Transportation Inst., College Station, Tex.

Rept. No. RR-139-3; RS-2-8-69-139; PB-196 012. ; 1970

Sponsored by Texas Hwy. Dept. in cooperation with Dept. of Transportation, Federal Hwy. Administration.

Availability: NTIS

RELATING PAVEMENT ROUGHNESS TO VEHICLE BEHAVIOR. FINAL REPORT

Road roughness, measured by the modified BPR roughometer in terms of the pavement roughness spectra of the highways in question, is related to the following aspects of vehicle behavior: steer angle of the left front wheel, steering wheel angle, sideslip angle, driver acceleration, and lateral tire forces (cornering forces). The steer angle or angular rotation of the left front wheel about the king pin axis as a criterion of controllability is less satisfactory than other criteria because changes in steer angle did not indicate effort on the part of the driver to control the vehicle and because the steering effect of one wheel cancelled the steering effect of the other wheel. The steering wheel angle, which is relatively easy to measure, is very sensitive to pavement roughness and thus is a good criterion for establishing levels of pavement roughness for straight pavement sections. Sideslip angle is not a good criterion because it is small and therefore difficult to measure, and because it is relatively insensitive to pavement roughness. Vertical driver acceleration is a good criterion because it appears possible to relate long wavelength roughness and short wavelength roughness with high and low frequency driver accelerations, i.e. to evaluate pavement roughness in different wavelength regions. Statistical distribution of lateral tire forces appears to be a valuable criterion of pavement roughness that is directly related to safe vehicle handling conditions. By establishing acceptable levels for steering wheel angle, vertical acceleration of the driver, and lateral tire forces, it is possible to set limits for pavement roughness. Normal tire forces should also be considered in establishing such limits.

by B. E. Quinn; E. W. Jones
Purdue Res. Foundation, Mechanical Engineering School,
Lafayette, Ind. 47907
Contract DOT-FH-11-8056
Rept. No. FHWA-RD-75-1; FCP-31H3-112; 1974; 118p 43refs
Other reports on this contract are FHWA-RD-75-2 and
FHWA-RD-75-3 (HS-019 996).
Availability: NTIS

HS-019 996

TENTATIVE ROAD ROUGHNESS CRITERIA BASED UPON VEHICLE PERFORMANCE. FINAL REPORT

Pavement roughness, defined in terms of two parameters of an equation representing the roughness power spectrum, is related to vehicle behavior in terms of dynamic tire force, passenger acceleration, and the probability of encountering insufficient lateral tire force. Vertical dynamic tire force influences pavement deterioration, lateral tire forces influence safe vehicle handling, and passenger acceleration is related to passenger comfort. Evaluating the roughness of a pavement is done by obtaining the pavement roughness spectrum by any suitable method, determining the values of P and Q by fitting the Zable equation to the roughness spectrum, and then consulting the set of curves in which P and Q are shown for various values of dynamic tire force, lateral tire force, and passenger acceleration. If, for any of the curve figures, the values of P and Q lie to the right of the dotted line, the pavement causes less desirable vehicle behavior than that produced by the roughest road considered in this investigation. Although the curves presented permit pavement evaluation for only one type of

vehicle at one velocity, the procedure easily can be expanded to include other vehicles and velocities.

by B. E. Quinn; S. R. Kelly
Purdue Res. Foundation, Mechanical Engineering School,
Lafayette, Ind. 47907
Contract DOT-FH-11-8056
Rept. No. FHWA-RD-75-3; 1975; 107p 15refs
Rept. for May 1974-Nov 1975. Other reports on this contract are FHWA-RD-75-1 (HS-019 995) and FHWA-RD-75-2.
Availability: NTIS

HS-019 997

TENTATIVE PAVEMENT AND GEOMETRIC DESIGN CRITERIA FOR MINIMIZING HYDROPLANING. PHASE 1. FINAL REPORT

Establishment of tentative criteria relating to geometric and pavement surface texture and cross slope to minimize highway hydroplaning is made on the basis of a comprehensive literature review, multistate questionnaires, mathematical model computer simulations, field testing, and data correlations. Empirical indications of hydroplaning are determined from interpretation of hard data developed with a spin down trailer, a hydroplaning trough, skid number trailers including drag and torque, and extensive tire and pavement testing under simulated rain. Equations relating pavement texture and cross slope and rainfall density are developed on the basis of previous measurements of surface drainage. Random and patterned textures covering the complete range of real world pavements are included. In a simulation of vehicle control as related to variation in cross slope, travel with constant velocity along a tangent path and a lane change maneuver at 60 mph (97 km/h) involving the transversal of a crown were tested for driver demand and vehicle control. State surveys were used to determine deficiencies in existing surface drainage design methodology for sag vertical curves. Tentative design criteria are developed for reduction of hydroplaning in which cross slope and texture are considered in relationship to specified rainfall intensities to produce the desirable maximum water depth. The importance of determining a design rainfall intensity for a given area is emphasized. Recommendations are made for construction of flexible and rigid pavements to minimize hydroplaning. For dense or impermeable surface the recommended minimum tentative surface macrotexture (0.4 inches (1.02 mm), and the minimum cross slope is 0.25 in per foot or 2% (with slight variations allowed for inside and outside lanes of roads of six or more lanes). In rural areas suggested tentative maximum macrotexture for the noise type of surface (chip seal) is 0.15 inches or 3.8 mm; for urban areas, 0.10 inches or 2.5 mm. For open or permeable surface minimum tentative surface macrotexture should be 0.05 in (1.3 mm). No maximum macrotexture value is recommended since noise is not generally a problem on open-graded surfaces. Tentative recommended polished stone values for various traffic volumes are tabulated, giving ranges as well as specific values. For asphaltic concrete surfaces, the open graded type mixture appears to be the best for minimizing hydroplaning, and is suitable for heavy traffic in both urban and rural areas. Other types include dense-graded asphalt concrete, skid-graded asphalt concrete, asphalt concrete with rolled-in precast chips, and asphalt seal coat. Portland cement concrete surfaces should be constructed with the use of a finishing machine separate from the curing machine and used between the paver and the curing machine. Graphic presentation

made of aligning torques for tangent path and of results of change maneuvers.

M. Gullaway; D. L. Ivey; H. E. Ross, Jr.; W. B. Potter; D. L. Woods; R. E. Schiller, Jr.

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act DOT-FH-11-8269

No. FHWA-RD-75-11; FCP-31H2-212 ; 1975; 211p 74rcfs
ibility: NTIS

9 998

BON MONOXIDE: A DANGER TO THE ER?

termine levels of carbon monoxide (CO) that might in
lose a risk to human health, an ECOLYSER 2600 was
to measure CO levels in three areas: the inside of an
automobile, the ventilating air entering the auto, and the
nt air at busy traffic intersections and positions. Fifty-
ars of various makes were tested, with a model year
from 1963 to 1974. Results showed a correlation between
vels in the exhaust and in the car interiors. Whether a
cant effect upon the driver results from exposure de-
on the time spent in the car: a long drive of several
could prove extremely dangerous in cars exceeding the
rd of 9 ppm for 8 hours. Many of the vehicles tested ex-
d this limit. Exhaust leaks into cars present further
r from nitrogen dioxide. Cars with air conditioners which
circulate the internal air could present a major risk,
ess risk from air conditioners permitting out air intake.
s from measurement of CO in air entering the car
d regular exceeding of the standard, depending on wind
ion and strength and traffic density. Air pockets trapping
ans showed higher CO levels in the car. In ambient air
ively traveled intersections, CO levels ranged from 3 to
n. Conclusions are that highest CO concentrations occur
fic delays and as a result of exhaust leaks, and may be a
buting factor in car accidents.

wis W. Mayron; John J. Winterhalter

Journal of the Air Pollution Control Association v26 n11
-8 (Nov 1976)

25rcfs

ibility: See publication

9 999

ZLING CAUSED IN CITY TRAFFIC BY CARS 'EN ON LOW BEAM

dy was made to determine whether the common use of
eams on automobiles for night driving in Polish cities, ir-
rative of general street illumination, might affect the ac-
rate. Tests were made of a driver's light perception or
ng when an oncoming vehicle was using low beams, of a
's light perception when using low beams himself and
nting an oncoming vehicle also using low beams, and of
ility of a driver using low beams to perceive an obstacle,
der various conditions of street lighting, height of
mps of the oncoming car, road conditions, and spatial
nships between the two vehicles. The common use (use
than in adverse weather conditions) of low beams for
driving was determined to be detrimental to traffic
. Corroborating evidence was obtained by polling of
s (the majority of whom felt that oncoming low beams

caused dazzling and should not be used except in conditions of
poor illumination), by a literature search, by theoretical cal-
culations of the dazzling effect, and by a review of accident
statistics in 1972 and 1973. Recommendations include restric-
tion of urban low beam use except on nonilluminated streets,
reduction of speed when vehicles travelling in opposite
directions pass each other, and front parking light power of 5
watts.

by Slawomir Golebiowski

Institute of Automotive Transport, Warsaw, Poland

Rept. No. 1896/ZA; 1975; 20p

Translation

Availability: Reference copy only

HS-020 000

RESEARCH PLAN FOR ACHIEVING REDUCED AUTOMOTIVE ENERGY CONSUMPTION

A Federally supported research program has been designed to
achieve improved fuel economy for internal combustion en-
gines and associated powertrain components used in vehicles.
Engine types considered include reciprocating and rotary spark
ignition gasoline engines, stratified charge variants, and diesel
engines; engine and powertrain components considered include
carburetors and fuel controls, ignition systems, and transmis-
sions. The recommended funding for the program is \$71 mil-
lion for a six-year period, with a peak funding of \$14.575 mil-
lion occurring in the third year. The seven areas of the plan
are general combustion research, engine and/or cycle-related
combustion research, materials research, friction reduction
research, alternative fuels research, engine controls research,
and diagnostic instrumentation research. The most important
restraint on fuel economy improvement is the need to meet
emission standards. Research in the area of hydrocarbon (HC)
emissions includes formation and destruction mechanisms,
mass transfer and scavenging in the cylinder, and the kinetics
of oxidation reactions. Oxides of nitrogen (NOx) emissions are
another pollutant for which additional knowledge of formation
processes and control techniques is needed, especially con-
sidering that future hydrocarbon fuels derived from oil shale
or coal will contain appreciable quantities of organic nitrogen.
Research in the area of understanding the combustion process
is to be both general and engine-related or cycle-related;
together, they account for two-thirds of the total funding
budget. General research is to include study of the generation
of both gaseous and particulate types of pollutants as well as
exhaust odor and combustion-generated noise; droplet and
spray combustion; flame propagation and quenching; and a
modeling effort with supporting experimentation. Engine
and/or cycle-related work is to deal with nonstratified charge
lean spark ignition engines, open-chamber stratified charge
spark ignition engines, prechamber spark ignition engines, ro-
tary spark ignition engines, and diesel engines. Materials
research is to consider fundamental heterogeneous catalysis,
chemical and metallurgical research, high temperature materi-
als for engine and exhaust systems, and noise reduction
materials and construction techniques. Fundamental
mechanisms of friction, wear, and lubrication are the subject
of the friction reduction program. A modest research program
is designed for potential alternative fuels, the most promising
of which are coal/shale liquids, neat methanol,
methanol/gasoline blends, and hydrogen. The work is to in-
clude investigation of fuel composition and properties, tox-
icology and safety, compatible materials and lubricants, and
exploratory combustion studies. The program concerning en-

gine operating parameters is to emphasize analytical aspects of feedback circuitry, evaluation of microprocessor control logic, transient operation, optimization studies, and sensor requirements. Diagnostic instrumentation is needed for accurate measurements of space-resolved and time-resolved local conditions in the engine combustion chamber as well as in the intake and exhaust systems; optical measurements based upon the use of a laser appear promising.

by Toru Iura; Wolfgang U. Roessler; Herbert M. White
Aerospace Corp., Environment and Energy Conservation Div.,
El Segundo, Calif. 90245
Grant S1A-74-17662-A-02
Rept. No. NSF/RA-760008; ATR-76(7467)-1; PB-255 929 ;
1975; 378p refs
Availability: NTIS

HS-020 001

**MOTOR CARRIER ACCIDENT INVESTIGATION.
TRI-STATE MOTOR TRANSIT COMPANY, INC.
ACCIDENT - FEBRUARY 13, 1976 - GILA BEND,
ARIZONA**

On 13 Feb 1976, at 12:25 p.m., a tractor trailer operated by Tri-State Motor Transit Co. transporting a containerized shipment of Class B explosives ran off the right side of Interstate 8 near Gila Bend, Arizona. It struck two automobiles, three motorcycles and four pedestrians standing on the roadway shoulder. Fire ensued. The accident resulted in one fatality, seven injured, and \$50,000 property damage. The probable cause was determined to be the driver dozing at the wheel due to fatigue or physical incapacitation. According to a witness, the truck was traveling on the highway shoulder with the truckdriver's head slumped over the steering wheel. The driver failed to take any evasive action. Further investigation revealed that the driver had obtained insufficient rest the night before and refused to submit to a blood alcohol content (BAC) test when told drug content as well as alcohol would be revealed. Manslaughter charges were filed on the driver, but he left the state before the warrant could be served.

Federal Hwy. Administration, Bureau of Motor Carrier Safety
Rept. No. 76-4 ; 1976; 13p
Availability: Corporate author

HS-020 002

**STRATEGIES FOR REDUCING GASOLINE
CONSUMPTION THROUGH IMPROVED MOTOR
VEHICLE EFFICIENCY. A REPORT OF AN
INFORMAL TRANSPORTATION RESEARCH BOARD
WORKSHOP**

Eight reports and a summary of an informal meeting to exchange ideas among professionals in the field of fuel economy are presented. Topics dealt with include policy-oriented modeling of new automobile sales and fuel consumption, market response to energy-saving ideas, and forecasting of long-run automobile demand. Also considered are the effects of lower speed limits on fuel consumption, safety research by NHTSA, fuel economy/emissions tradeoffs, fuel economy excise taxes and rebates, and the possible use of electric vehicles. More papers were presented at the meeting than are

represented in the publication. Participants and their affiliations are listed.

Rept. No. TRB-SP-169; 1975; 57p refs
Proceedings of a workshop sponsored and conducted by the Transportation Research Board Com. on Energy Conservation and Transportation Demand, Washington, D.C., 7-8 Oct 1975. Publication of Proceedings sponsored by Federal Energy Administration and Dept. of Transportation, Transportation Systems Center. Includes HS-020 003--HS-020 010.
Availability: TRB

HS-020 003

**POLICY-ORIENTED MODELING OF NEW
AUTOMOBILE SALES AND FUEL CONSUMPTION**

Interactive computer models project changes in the use of ownership of automobiles, a scrappage model estimates the number of automobiles in each age class that will be scrapped, and a new automobile market segmentation model estimates changes in the mix of new automobiles sold in each of the size classes. The basic argument of the models is that new sales equal the sum of the change in the number of units in operation (the growth component of the market) and the number of units scrapped (the replacement component of the market). The models were programmed in TIME-SHARE BASIC. The models age the automobile population year by year and forecast the number of new automobiles that will be sold and added to the inventory of automobiles in use. The models include a number of economic variables relating to costs of ownership and operation: average value distributive damage rate distribution, and repair cost distribution. The models are a helpful analytical tool for considering impacts of various policy choices and varying assumptions about market responses, i.e. to consider the relationships among market forces, government forces, and industry response.

by Robert P. Whorf
Robert Whorf and Associates
Publ: HS-020 002 (SP-169). "Strategies for Reducing Gasoline Consumption through Improved Motor Vehicle Efficiency." Washington, D.C., 1975 p5-11
1975; 1ref
Availability: In HS-020 002

HS-020 004

**RESPONSE OF AUTOMOTIVE MARKET TO
ENERGY-SAVING IDEAS**

Purchase and usage behavior, automobile maintenance, and driving behavior relative to fuel economy are considered from the consumer's point of view. Although the American public is aware of the energy crisis, a recent Gallup poll shows that a fuel shortage ranks fifth in a field of nine national problems. Purchase behavior, probably the most unbiased clue to the consumer's feeling about the energy crisis, shows that there is only a very modest increase in smaller, more efficient cars continuing good sales of luxury cars, and a decrease in purchase of intermediate size cars. Use of car pools and public transportation does not seem to be increasing. There has been a great increase in tune-ups. The 55 mph speed as an energy-saving form of driving behavior does not seem to be completely accepted. The public will not readily change

s unless the crisis becomes very evident and/or the
rities make a unified statement of the problem.

ymour Marshak
Mexico State Univ., School of Business
HS-020 002 (SP-169), "Strategies for Reducing Gasoline
umption through Improved Motor Vehicle Efficiency,"
ington, D.C., 1975 p12-3

availability: In HS-020 002

20 005

ECASTING LONG-RUN AUTOMOBILE DEMAND

ethod for forecasting long-run automobile sales, travel de-
s, and gasoline consumption as a function of policy-in-
1 shifts in new automobile prices is based on two equa-
: one for estimating total new automobile sales in some
e year and one for detailing the composition of total sales
ehicle size class. Secondary equations introduce the ef-
f of population and affluence, combine the various costs
iated with owning and operating a vehicle, and estimate
rate at which vehicles are retired from service. The
dure requires detailed consideration of the automobile
composition throughout each year of the forecast period.
hat process, the sales projection components are dealt
An equation is also estimated for the scrappage factor.

arnian J. Kulash
Faucett Associates, Inc.
HS-020 002 (SP-169), "Strategies for Reducing Gasoline
umption through Improved Motor Vehicle Efficiency,"
ington, D.C., 1975 p14-9
6 refs
availability: In HS-020 002

120 006

ECT OF LOWER SPEED LIMITS ON FUEL NSUMPTION AND SAFETY

ion 107 of the 1974 Federal-Aid Highway Act designates
enforcement certification as a continuing prerequisite for
oval of Federal-aid highway projects. The certification
edure requires that states submit summaries of speed data
cted on highways on which the speed limit is the only
traint on speeds. The Federal Highway Administration's
ederal Guide for Speed Monitoring gives recommended
edures and criteria for the sampling effort, based on free-
ing traffic of all types on all state roads with the 55 mph
d limit as the major speed constraint. Tabulated data show
oved fuel economy for both passenger vehicles and trucks
a decrease in highway fatalities under conditions of the 55
speed limit.

larence W. Friesen
ral Hwy. Administration, Program Management Div.
HS-020 002 (SP-169), "Strategies for Reducing Gasoline
umption through Improved Motor Vehicle Efficiency,"
ington, D.C., 1975 p20-2

availability: In HS-020 002

HS-020 007

VEHICLE SAFETY RESEARCH AND THE "TOTAL" VEHICLE

The vehicle safety research of the National Highway Traffic
Safety Administration is leading to total vehicle concepts that
will have a balance of safety, economy, energy conservation,
and environmental protection. In 1968, the Experimental
Safety Vehicle Program initiated the development of the total
vehicle system in which all aspects of safety were considered,
including crash avoidance and crashworthiness. Four experi-
mental safety vehicles were built in the U.S., and nine were
constructed in other countries. The next step is the Research
Safety Vehicle Program, which has as its goal a vehicle that
weighs less than 1361 kg (3000 lb), that reduces the societal
cost of automobile accidents in the 1985 time period, and that
attains national goals in energy conservation, environmental
protection, and life-cycle economy. The first phase of this pro-
gram defined the role and projected operating environment for
passenger vehicles of the mid-1980's and developed per-
formance specifications of a vehicle concept based on societal
benefit studies. Fuel costs and kilometers driven are expected
to increase, but the percentage of family budget for automo-
biles will not. This will result in the demand for a smaller,
more efficient automobile, which will lead to a dramatic in-
crease in the societal cost of small-automobile accidents. The
preliminary designs of the research safety vehicles by the five
contractors were based on those types of considerations. Fea-
tures of the designs include low weight, optimized structure
and restraints, and compatibility with vehicles of other sizes.

by Vincent J. Esposito
National Hwy. Traffic Safety Administration, Office of
Vehicle Safety Res.
Publ: HS-020 002 (SP-169), "Strategies for Reducing Gasoline
Consumption through Improved Motor Vehicle Efficiency,"
Washington, D.C., 1975 p23-30
1975
Availability: In HS-020 002

HS-020 008

TRADE-OFFS BETWEEN FUEL EFFICIENCY AND EMISSIONS

To provide an indication of the potential for improved brake-
specific fuel consumption (BSFC) through engine redesign and
improvements in engine control, three concepts are discussed
in detail: a lean, high-turbulence, high-compression ratio en-
gine, with first a manifold reactor and then an oxidation
catalyst, and a close-to-stoichiometric engine with exhaust gas
recirculation (EGR) and secondary air for engine oxides of
nitrogen, hydrocarbon and carbon monoxide emission control
and with catalysts for additional exhaust cleanup. This im-
provement in fuel economy from the engine is estimated at
20%. It is deduced that the estimated 40% improvement in fuel
economy by 1980 will be a result of a reduced vehicle weight
and some improvements in vehicle design in addition to engine
improvements. Estimates of the fuel economy improvements
necessary to eliminate add-on devices point out the impossi-
bility of this method of control. The use of spark retard and
exhaust manifold reactors will be necessary to meet the
hydrocarbon standard of 0.25 g/km in even the best lean-burn-
ing systems, and a reducing catalyst will be necessary for ox-
ides of nitrogen control at the 0.25 g/km standard. The cold-
start emission problem for conventional spark-ignition engines

will be alleviated by improved carburetors and new carburetors combined with improved intake systems. Experimental lean-burn systems have shown good hydrocarbon and carbon monoxide control. Emission improvements from these lean-burn systems are largely due to improvements in their cold-start emissions and fuel economy.

by Rodney J. Tabaczynski
Massachusetts Inst. of Tech., Sloan Automotive Lab.
Publ: HS-020 002 (SP-169), "Strategies for Reducing Gasoline Consumption through Improved Motor Vehicle Efficiency,"
Washington, D.C., 1975 p31-9
1975; 9refs
Availability: In HS-020 002

HS-020 009

ANALYSIS OF FUEL ECONOMY EXCISE TAXES AND REBATES

Excise taxes on fuel inefficient automobiles and rebates for fuel efficient automobiles have been proposed to reduce gasoline consumption by encouraging a more fuel efficient automobile fleet. These taxes and rebates will precipitate changes in gasoline consumption by inducing manufacturers to improve the fuel efficiency of their autos, encouraging consumers to purchase autos with better fuel economy, changing the total level of autos sold, reducing the operating costs of new autos, and changing the use and scrappage of used autos. A methodology is presented for estimating the impact that various auto excise tax and rebate proposals will have on fuel consumption, fuel economy of the new auto fleet, and total auto sales. This analysis explicitly considers the cost to improve the technical efficiency of automobiles and the potential for shifting consumers to smaller autos, and includes both supply and demand of new autos. The results of the analysis are displayed graphically for a prototypical excise tax proposal.

by Carmen Difiglio
Federal Energy Administration, Office of Transportation Res.
Publ: HS-020 002 (SP-169), "Strategies for Reducing Gasoline Consumption through Improved Motor Vehicle Efficiency,"
Washington, D.C., 1975 p40-6
1975; 2refs
Availability: In HS-020 002

HS-020 010

STRATEGY FOR SAVING GASOLINE BY SUBSTITUTING LOW PERFORMANCE ELECTRIC VEHICLES

Electric vehicles (EV's) can be an attractive alternative to the internal combustion engine (ICE) as a means of saving fuel. However, the present high costs of an EV tend to discourage its adoption. If a mass market for EV's were developed (producing runs of 1 million), the present relatively primitive technology limits could be overcome as even the present technology is adequate to meet requirements. An EV using present technology and comparable in size and performance to the VW beetle would cost about \$3000. The greatest expense is the battery, which costs an additional \$440 and must be replaced every 20,000 miles or so. If the growing two-car per household market could accept an EV as one of those cars, attractive economic incentives could be arranged on a monthly payment basis: six-year financing instead of the present three on ICE vehicles because the EV life is twice that of the ICE:

lower insurance rates because of lower speed travel; lower financing rate; renting batteries until battery technology improves, after which monthly buying costs would be substituted for monthly rental costs; and diverting a percentage of the Federal tax to cover the high cost of using the interim lead acid batteries. Monthly payments based on these factors would compare favorably with present payments for ownership of a Honda costing \$3000. Incentive for the manufacturer depends on strong market demand, and such demand might be raised by lowering the driving age to 15 for EV drivers.

by Summer Meyers
Institute of Public Administration
Publ: HS-020 002 (SP-169), "Strategies for Reducing Gasoline Consumption through Improved Motor Vehicle Efficiency,"
Washington, D.C., 1975 p47-9
1975; 4refs
Availability: In HS-020 002

HS-020 011

1974 ACCIDENTS OF MOTOR CARRIERS OF PROPERTY

Statistical analyses are made of 1974 accidents involving motor carriers (truckers) engaged in interstate, intrastate, or foreign operations in which a human death occurred, medical attention away from the scene of the accident was needed, or total property damage was \$2,000 or more. Types of analysis presented include a statistical summary; a geographic summary; carrier, personnel and trip involvement; vehicle and cargo information; location and roadway; environment; and accident information. In 1974, there were 25,358 accidents reported to the Bureau of Motor Carrier Safety by Motor Carriers of Property. These resulted in 2,429 fatalities, 26,911 injuries, and \$151.7 million in property damage. Of those killed in reported accidents, 484 were truck drivers, another 95 were other truck occupants, while 1,900 were pedestrians or occupants of other types of vehicle. Collision accidents which occurred on over-the-road trips accounted for 55% of the total number of accidents, 74% of the fatalities, 61% of the injuries, and 53% of the property damage. Noncollision accidents which occurred on over-the-road trips accounted for 23% of the accidents, 12% of the fatalities, 15% of the injuries, and 36% of the property damage. Some 18% of the accidents reported were collisions of vehicles engaged in local pickup and delivery operations. These accounted for 12% of the fatalities, 21% of injuries and 8% of property damage. Noncollision accidents which occurred on local pickup and delivery trips were lowest in all aspects, accounting for 3% of accidents, 1% of fatalities, 2% of injuries, and 3% of property damage.

Federal Highway Administration, Bureau of Motor Carrier Safety
1975; 72p
Availability: Corporate author

HS-020 012

STOP SIGNS FOR SPEED CONTROL?

Three studies were conducted on residential streets in Troy, Mich. to determine the effectiveness of stop signs as speed control devices. Speed and stop sign observance studies were made before and after installation of a stop sign. Results showed a slight increase in peak speeds after stop signs were installed and a slight decrease after signs were removed.

Furthermore, stop signs placed for speed control were found to be generally disregarded: at the three locations, approximately half of the motorists made a rolling stop; one quarter came to a full stop, and one quarter did not stop at all. It is concluded, therefore, that stop signs are not effective speed-control devices on residential streets.

by Richard F. Beaubien

Publ: Traffic Engineering v46 n11 p26-8 (Nov 1976)
1976

Availability: See publication

HS-020 013

ANALYSIS OF SOME EFFECTS OF SEVERAL SPECIFIED ALTERNATIVE AUTOMOBILE EMISSION SCHEDULES

Five different emission control schedules are compared in terms of their effects on implementation of more stringent standards. They include an amendment offered by Rep. John D. Dingell and earlier suggested by Environmental Protection Agency Administrator Train (schedule DT), a combination of two similar schedules considered by House Interstate and Foreign Commerce Committee (schedule A-C), a schedule contained in the current Senate Public Works Committee Bill S.32.9 (schedule B), a schedule adopted by House Interstate and Foreign Commerce Committee (the Brodhead Amendment) H.R. 10498 (schedule D), and an extension of the present Federal standards indefinitely for analytical purposes (schedule E). The analysis assumes that major vehicle weight reduction programs will occur regardless of which emission control schedule is imposed, and that the model mix of 40% full-size/30% medium-size/30% small-size cars will continue through 1985. All schedules but E give figures in ranges. Estimated fuel economy impacts are presented in terms of miles per gallon for the new car fleet for each model year and of percentage differences of fuel economy for each schedule relative to schedule DT, rounded to the nearest full percent. Lifetime fuel consumption of the new car fleet is presented by model year for the DT schedule. It is assumed that the average car is driven 100,000 miles, that the annual new car fleet is 10 million cars, and that all engines are gasoline powered. The impact of diesel vehicles on new car fleet average fuel economy is also charted. Analyses concerning health benefits present air quality effects of the various emission control schedules in general and for hydrocarbons, carbon monoxide, and oxides of nitrogen, respectively. Other tables deal with projections of the percentage reduction in ambient concentration of mobile source related air pollutants in 1990 in comparison with base years in the early 1970's for the DT emission control schedule; the number of air quality control regions that are projected to exceed the national primary ambient air quality standard for each pollutant in 1990 for each schedule; and the projected numbers of aggravation of heart and lung disease in elderly patients, incidents of eye irritation, and excess headaches in 1980, in 1990, and for the total period from 1980 through 1990 due to oxidants: excess cardiac deaths and person hours of disability due to ambient carbon monoxide; and lower respiratory disease in children due to oxides of nitrogen emissions. Consumer cost impacts are tabulated in terms of differences (in 1975 dollars) between each emission control schedule and schedule DT, for low and high range estimates. Also, the undiscounted lifetime costs for the entire new car fleet in each model year are presented.

Department of Transportation: Federal Energy Administration
1976; 36p

Availability: Corporate author

HS-020 014

TRADEOFFS ASSOCIATED WITH POSSIBLE AUTO EMISSION STANDARDS. A REPORT TO THE ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

Five scenarios are presented as the estimated results of five different decisions and recommendations the Administrator might make on the impacts of changes in emission control technology. The impacts considered are direct rather than indirect results of changes and include changes in vehicle cost, vehicle fuel economy, and unregulated pollutant level. The five scenarios are as follows. First, suspend 1977 standards; set interim standards and recommend a freeze at 1.5 hydrocarbons (HC), 15 carbon monoxide (CO); implement a crash program that results in the elimination of catalysts from 1977 models. Second, suspend 1977 standards; set interim standards and recommend a freeze at 0.9 HC, 9.0 CO. Third, suspend 1977 standards; set interim standards of 0.9 HC, 9.0 CO, 2.0 oxides of nitrogen (NOx); recommend 0.41 HC, 3.4 CO, 2.0 NOx for 1978 through 1980. Fourth, deny; recommend 2.0 NOx through 1980. Fifth, deny; recommend lowest possible NOx through 1980. The report team projected the following. The first cost difference between the various scenarios ranges from a maximum of \$160 in the 1977 model year to \$180 in 1980. The difference in fuel economy between various scenarios ranges from 9% in 1977 to 5% difference in 1980. The technology can be available by 1980 to produce engines that are essentially unaffected by differences in emission standards between 1.5, 15, 3.1, and 0.41, 3.4, 2.0. The 5% and 2.5% higher fuel economy for 1980 in the first two scenarios results from the assumed use of leaded fuel and one full unit higher compression ratio. The minimal disadvantages of the systems that require unleaded fuel may be reduced or eliminated by future engine modifications that facilitate the use of higher compression ratio. Sulfate emission levels are estimated to range from a high of 0.05 gpm for the systems that use high sulfur fuel and oxidation catalysts with air injection to a low of less than 0.005 gpm, which can be met by noncatalyst systems if a blending and allocation program is implemented. With minimal control over unleaded fuel sulfur levels and moderate vehicular sulfate control, levels of sulfuric acid emission of 0.013 gpm are considered possible at the 0.41 HC, 3.4 CO, 2.0 NOx levels. The following conclusions were reached. 1980 fuel economy is estimated to be 7-13% better than 1975 due to engine efficiency improvements for all emission standards between 1.5, 15, 2.0 and 0.41, 3.4, 2.0. With still lower NOx levels (1.8 gpm in 1980) fuel economy in 1980 will be about the same as for 1975 models. Further reductions of NOx levels beyond this level of 0.8 gpm would result in fuel economy penalties relative to 1975 models. Low NOx systems below 2.0 gpm are estimated at \$250 more than 1975 systems. Emission control system costs in 1980 for the four scenarios depicted are estimated to be between \$30 more and \$150 less than 1975 systems. The eventual, circa 1980, first cost and fuel economy penalties for the 1977 statutory emission standards compared to the 1.5, 15, 2.0 level will be about \$180 and -5% in economy. Due to the use of unleaded fuel, lower maintenance cost for the 41, 3.4, 2.0 system, however, will more than counterbalance the first cost penalty. Sulfate levels will depend on the emission standard level and the extent to which the sulfur of gasoline is reduced. Tighter emission standards will result in higher sulfate levels unless fuel sulfur is reduced or a vehicular sulfate control program is implemented, but significantly lower fuel sulfur levels than were assumed in the Environment-

tal Protection Agency (EPA) sulfate issue paper appear to be achievable without desulfurization.

Emission Control Technology Div., Mobil Source Pollution Control Program
1975; 35p 9refs
Availability: Environmental Protection Agency

HS-020 015

ALCOHOL SAFETY ACTION PROJECT BIBLIOGRAPHY

A bibliography is presented which lists all reports and articles by or about specific Alcohol Safety Action Projects (ASAP) and the ASAP program, in general, which are contained in the Highway Safety Research Institute (HSRI), Research Information and Publications Center. HSRI has attempted to obtain analytic studies and survey reports from individual ASAP's as well as from the National Highway Traffic Safety Administration. Documents from specific ASAP's are listed by state and are preceded by a list of general ASAP reports and articles. All sections are in chronological order, and NTIS order numbers have been given when available. Four ASAP's are not represented since reports were unavailable from them: Delaware (statewide); Idaho (statewide); Maine (Cumberland and York counties); and Puerto Rico (Commonwealth).

by Ann C. Grimm, comp.
University of Michigan, Hwy. Safety Res. Inst., Huron
Parkway and Baxter Road, Ann Arbor, Mich. 48109
Rept. No. UM-HSRI-76-19; 1976; 38p
Availability: NTIS

HS-020 016

THE EFFECTIVENESS OF MILES-PER-GALLON METERS AS A MEANS TO CONSERVE GASOLINE IN AUTOMOBILES. REPORT TO THE CONGRESS AND THE PRESIDENT FROM THE SECRETARY OF TRANSPORTATION

A miles per gallon (MPG) meter is an instrument that measures and displays to the driver the fuel economy of his car in miles per gallon by using sensors to measure fuel flow in gallons per hour and speed in miles per hour. Mpg meters are manufactured by only three U.S. companies: the FloScan Instrument Co., the Miles Instrument Co., and SpaceKom Inc., and are composed of two transducers, a signal processor and a display unit. The various meter components, speed transducers, fuel-flow transducers, electronic signal processing circuitry, and display meters are discussed briefly. The ease of installing an mpg meter depends on the lay-out and accessibility of the car's engine compartment. Four separate items must be installed: speed transducer, fuel-flow transducer, display meter, and the interconnecting electric wiring. Two field studies were initiated by the Transportation Systems Center to determine if and where mpg meters can be used to save fuel and to determine if drivers use them for that purpose. The results of eight weeks of evaluation are presented. Mpg meters have to be monitored closely to be used effectively, that they show that cars get better gas mileage as they warm up, and that the mean mpg performance was 1.5% higher for meter equipped cars than for comparison groups, but a "t" test calculated to evaluate this difference indicated that it is not statistically reliable. Mpg meters are considered a potential safety hazard because of the danger of inattention during driv-

ing, though this may be reduced as the driver's experience with the device increases. A number of disadvantages of current meters could be corrected through redesign and matching the meters to cars in which they will be used. A parametric analysis was conducted of the value of fuel savings as a function of time for different assumptions about the improvement in fuel economy that may be achieved through use of mpg meters. The analysis was conducted for assumed increases in fuel economy ranging from 2% to 10% over a ten year period. Potential national gas savings were determined for installation of mpg meters in all new and used cars and for installation in new cars only. Potential dollar savings to the individual driver were determined for all cars currently on the road and for new cars, large and small. Results show that, if meters were installed only in new cars, the potential cumulative fuel savings would be between 6.2 and 29.0 billion gallons. Means of encouraging the purchase and use of mpg meters include: public advertising; driver education, tax benefits in the form of income tax reduction or tax credits, direct subsidy to manufacturers of meters by the government. The issues which are associated with the mandatory installation of meters in new cars are discussed. Installation should not be mandated until fuel economy and cost effectiveness are demonstrated. The cost impact of installation should not be greater for less expensive cars. The effects on the automotive industry such as lowered sales should be considered, and the cost of a Federally administered program should be weighed. It has not yet been demonstrated that the use of current mpg meters will improve fuel economy for typical drivers. Recommendation is made that Congress not require installation on new cars at this time. Appendices include other driver aids for conserving gasoline such as manifold vacuum gauge, speed or cruise control, fuel-flow meters, and fuel totalizers, and a summary of public comments on fuel flow meters.

by M. Stephen Huntley, Jr.; William Z. Leavitt
Department of Transportation, Transportation Systems Center,
Kendall Square, Cambridge, Mass. 02142
Rept. No. DOT-TSC-OST-76-38; 1976; 69p 13refs
Rept. for Jan-Jul 1976.
Availability: NTIS

HS-020 017

MOTORIST AID SYSTEMS STUDY. STATE OF THE ART REPORT. FINAL REPORT

A motorist aid system (MAS) involves detection of the disabled motorist, definition or identification of the type of assistance needed, dispatch of a service vehicle, provision of the needed service, and recording or documenting the occurrence. The type of MAS chosen should suit the environment: rural freeways, urban freeways, bridges and tunnels, or free-access roads. The MAS should be in proper relationship with any incident management systems, emergency medical services, or motorist information systems in the area, perhaps sharing a communications system (e.g. New York State's Integrated Highway Telecommunication Network). The Federal Highway Administration (FHWA) has concerned itself with MAS's, particularly roadside callbox systems in cooperation with State agencies. Roadside callbox installations may have a coded push-button arrangement, a two-way voice system, or commercial telephones with an emergency number or a WATS toll-free number. An example of a cooperative, motorist-actuated system is Flash Lights And Send Help (FLASH), in which a passing motorist who stops to aid a disabled vehicle flashes his high beams three times in a designated area

equipped with photoelectric detectors. In-vehicle communications include citizen's band (CB) radios, perhaps with volunteer monitoring such as in the Radio Emergency Associated Citizens Teams or REACT, or Affiliated League of Emergency Radio Teams or ALERT. Mobile telephone service is also used. Patrols can be made by highway personnel or by police. Some specialized systems include single-frequency communications, DAIR and Retrolite systems, and auto radio adapters. Automatic incident detection systems are not considered feasible. Descriptions are given of specific MAS's. The advantages and disadvantages of each type are considered. An ideal system would be a combination of callboxes, courtesy patrols, and a CB radio network. Evaluation of MAS's should be made on the basis of such factors as maintenance experience, cost considerations, supervision of responding agencies, human factors considerations (e.g. motorists' awareness, familiarity, acceptance, and tolerance), system evaluation, and physical design considerations. System cost is not to be confused with cost effectiveness. Agency-operated services generally have a much shorter response time than privately operated services. System evaluation and physical design evaluation can be made on the basis of FHWA standards; examples are given. A framework is developed to assist the planner of a callbox MAS, taking into consideration the responsible agencies including sharing of responsibilities, characteristics of service agencies (patrols, ambulance, auto service, and firefighting), impact of response procedures, and role of the dispatcher. Assessment is made of some current response plans. Software (operational procedures and the response plan) has been the greatest problem area in the past. The planning process should include both current and future needs, establish an ends-means relationship, and include all appropriate agencies as participants. Objectives should be charted and alternative MAS's considered in light of them. A bibliography of almost 500 items, the more important ones annotated, is presented. All documents cited are obtainable. Appendices give a functional description of MAS elements, needs analysis, an MAS evaluation technique, and hardware specifications.

JHK and Associates, 275 Fifth Street, San Francisco, Calif.
Contract DOT-FH-11-8745
Rept. No. IP-76-11; 1976; 306p 467refs
Rept. for May 1975-Jun 1976.
Availability: Federal Hwy. Administration, Office of Development--Implementation

HS-020 018

STRATIFIED CHARGE ENGINES

The acceptabilities of various types of stratified charge engines were determined as potential power plants for light duty vehicles and motorcycles in America. The light duty vehicle considered was a 4/5 seat compact sedan with good acceleration capabilities and exhaust emissions below a primary target of 0.41 g/mi hydrocarbons (HC), 3.4 g/mi carbon monoxide (CO), 1.5 g/mi oxides of nitrogen (NOx). A secondary target of 0.4 g/mi NOx was also considered. Stratified charge engines in the literature were compared with examples of good conventional gasoline and diesel engines. While some stratified charge engines had exhaust emission or fuel economy advantages, there were always sacrifices in other areas. Eleven engines were configured, four of which were specifically directed towards the secondary emission targets. A method of rating

engine at the primary emission target, and that both of these systems, together with the VW combustion process, might be suitable at the secondary targets. Other conclusions were reached. The specific output of naturally aspirated stratified charge engines is lower than that of conventional gasoline engines at the primary emissions target. Stratified charge engines are generally more complex and costly than conventional engines, and generally larger and heavier than conventional engines. Most stratified charge engines are noisier than the conventional engine. Finally, at the emissions targets considered, stratified charge engines are not attractive for motorcycle engines, mainly for economic reasons. Further research and experimental studies of the more successful features of the stratified charge engines are recommended.

by R. A. Haslett; M. L. Monaghan; J. J. McFadden
Ricardo and Co. Engineers (1927) Ltd.; Environmental Protection Agency
Rept. No. SAE-760755; 1976; 16p 3refs
Presented at Automobile Engineering Meeting, Dearborn, 18-22 Oct 1976.
Availability: SAE

HS-020 019

UNDERSTANDING TIRES

Three basic types of tires exist for everyday use under average conditions: bias ply, bias belted, and radial ply. The first type have plies that run in a lattice-like pattern; the radial's plies run directly across the crown. Handling characteristics vary. Compared to the other two, the radial has better steering control and is smoother at high speeds. However, it has a lower cornering limit and will approach the breakaway point with less warning. The bias ply sacrifices some precision in quick transient maneuvers and doesn't truck as well. The bias ply will out-perform an American radial, but European radials, though much more expensive, are superior to the bias ply. The medium-low priced radials give a better cost-per-mile ratio than the others, despite the higher original cost. Steel appears the best wrapping currently, but some synthetic wrappings are showing outstanding performance. Fabrication material affects handling patterns, noise levels, ride comfort, and overall cost. The steel belt will generally out-perform and outlast the fabric-belted radial, but gives a slightly less comfortable ride, and is noisier and more costly. Other factors affect comfort, handling, and wear characteristics: generally larger tire patterns are noisier; soft or hard compounds affect braking distances; and quiet tread has poor road grip. The series number is based on the aspect ratio and the three European speed-rating code letters are used to imply excellent car condition for full use value. Three tires are detailed in an item-by-item breakdown: the Firestone new deluxe Champion, a Goodyear custom polysteel radial, and a Pirelli. Twenty-four tire definitions are given. Three publications by Tire Guide are useful to the consumer. Tire mixing rules follow the general maxim: don't mix tires or different size or construction on the same axle.

by Larry Griffin
Publ: Road Test v13 n1 p56-9 (Jan 1977)
1977
Availability: See publication

HS-020 020

STRUCTURAL ANALYSIS OF LADDER FRAMES UNDER TORSION

The determination of the torsional stiffness of a ladder frame is investigated and a comparison is made between the assumptions of infinite and finite bending stiffness of the members. A method is proposed for the estimation of the torsion constants of the members of a ladder frame and is shown to give good agreement with measured values. Stress distributions in the cross members of a ladder frame are determined using the warping restraint factor k . Charts are presented to enable the torsional stiffness and stress distributions to be calculated for ladder frames comprised of channel and I-Section members.

by T. H. G. Megson; G. A. Alade
 Publ: Proceedings of the Institution of Mechanical Engineers
 v190 n38/76 p409-18 (1976)
 1976; 13p 13refs
 Availability: See publication

HS-020 021

TEMPERATURE DISTRIBUTIONS IN AUTOMOTIVE DRY CLUTCHES

A numerical method that involves setting up equations to express the heat balance at every region in the clutch is used to determine the temperatures at various elements when hand contact occurs between the rubbing surfaces during the operation of an automotive clutch. Temperature calculations have been made for contact areas of different band width on the two clutch facings and the results obtained compared with those attained when complete contact occurs. Both single and repeated engagements were made at regular intervals using three configurations involving different regions and areas of rubbing contact, with each configuration dissipating the same total energy during an engagement. Results of single engagements are compatible with the thermal behavior found in practice. Results of repeated engagements showed much greater temperature rise than single engagements. Attention must be paid to the relative position of the thermocouples used to measure temperature, with respect to the contact band in the radial direction. Considerable error may exist in extrapolations due to the very steep temperature gradients across and adjacent to the contact band. Thus, measured values can differ markedly from real temperatures, especially in a nonuniform contact situation, a possible explanation for the considerable disagreement usually reported in such studies.

by M. El-Sherbiny; T. P. Newcomb
 Publ: Proceedings of the Institution of Mechanical Engineers
 v190 n34/76 p359-65 (1976)
 1976; 11refs
 Availability: See publication

HS-020 022

A MECHANICAL TORQUE CONVERTER, AND ITS USE AS AN AUTOMOBILE TRANSMISSION

A torque converter is described in which the prime mover is directly coupled to a pulsator unit whose function is to convert the steady torque of the prime mover into an alternating torque of controllable amplitude. Sprag-type clutches are used to rectify this torque and to transmit it to the converter output shaft. A typical pulsator design is described to illustrate the

properties of the torque converter. A developed version of this basic design for use as an automobile automatic transmission is described. The converter was tested in a Triumph 13/60 and acceleration, hill climbing, noise level, and general driving tests were conducted. Theoretical and experimental performance curves are given which show that an automobile drive is possible which approaches a manual transmission for fuel consumption and performance. Tables, graphs, and schematic drawings illustrate converter function and test results.

by Frederic Williams; D. Tipping
 Publ: Proceedings of the Institution of Mechanical Engineers
 v190 n32/76 p447-56
 1976; 3refs
 Presented for presentation at an Ordinary Meeting of the Institution of Mechanical Engineers, Automobile Div., Coventry, 14 Oct 1975.
 Availability: See publication

HS-020 023

DYNAMIC BEHAVIOUR OF A ROAD VEHICLE WITH REAR WHEEL ADAPTIVE BRAKING CONTROL

Vehicle response during braking is investigated with the aid of a mathematical model having a realistic road input. Using an integrated hybrid computer, the road-tire characteristics are simulated by generating nonlinear functions on the digital computer, while the mathematical model is described on the analog computer with parallel logic facility. An adaptive braking control system is proposed which measures and processes the rear-wheel motion. Activation of the system occurs when the wheel deceleration and a quasi wheel slip reach given reference values. The adaptive system as developed and optimised on the hybrid computer is implemented on the rear wheels of the test vehicle. The predicted values of wheel speed, brake-pressure modulation, stopping distance, and vehicle yaw are shown to compare favorably with the test results.

by S. W. E. Earles; B. R. Aurora
 Publ: Proceedings of the Institution of Mechanical Engineers
 v190 n19/76 p233-44 (1976)
 1976; 8refs
 Availability: See publication

HS-020 024

FUEL VAPOURIZATION. ECONOMY WITH REDUCED EXHAUST EMISSION

A simple system is described of controlling exhaust emissions from gasoline engined vehicles, using a coolant heated fuel vaporizer in the inlet system. The object of complete vaporization of the fuel is to create a homogeneous inlet charge, giving improved cylinder-to-cylinder distribution and permitting operation with very lean mixtures. This leads to low exhaust emissions of carbon monoxide, hydrocarbons, and nitric oxides. The effects of vaporization on the lean limit of operation, exhaust emissions, power output, fuel consumption, and optimum spark ignition timing have been investigated. It was found that the misfire lean limit is extended when using the vaporizer. Results show that the power loss incurred with a fully vaporized mixture and air fuel ratio of 19.5:1 was about 30% of the engine's maximum brake power. Vaporization reduces fuel consumption, especially with lean mixtures and with light engine loads. Relatively less spark advance is

alized fuel than with normal carburetion. A 1.6 liter car are also presented. It was found that emissions were effectively controlled, fuel economy remained acceptable. Engine power was reduced by 30%, although fuel consumption was not and photographs illustrate function and operation.

J. R. Goulburn
of the Institution of Mechanical Engineers
(1976)

presented at an Ordinary Meeting of the
Institution of Mechanical Engineers, Birmingham, 8 Jan 1976.
Publication

THROTTLE POSITIONING AND THE EFFECTS OF TURBULENCE ON NOX GAS EMISSIONS OF A SPARK ENGINE

The effect of turbulence in the isolated cylinder of a spark ignition engine was changed by the preparation in the induction tract and by the flow velocity through the valve aperture by the change of the full lift of the inlet valve and the mass rates of the emissions of carbon monoxide, nitric oxide, and hydrocarbons of controlled with a conventional throttle, are compared with the valve throttled engine. It was found that the valve throttling device is employed with dilution and a weak mixture, all species of pollutants can be reached significantly below the stoichiometric engine, with a similar treatment or mixture do not carry the penalty of a high fuel consumption. It is usually the case for low pollution engines that exhaust gas recirculation is shown to have a beneficial effect on the comparison and to be essential.

Graphs illustrate various results of emissions.

Hodgetts
of the Institution of Mechanical Engineers
(1976)

presented at an Ordinary Meeting of the
Institution of Mechanical Engineers, Birmingham, 8 Jan 1976.
Publication

HARDWARE EFFECTS OF FMVSS ON VEHICLE SAFETY STANDARD

The publication of the former SAE voluntary standards as one of a number of test procedures to show the acceptability of brake system. The SAE J105-75 established criteria that do not apply to the real world, and the following criticisms from industry and the Automobile Manufacturers Association: a certain amount of lead time is required for development, and tooling of hardware to meet the criteria. If sufficient lead time is not provided, the criteria are not met by the effective date. Second, brake

standards should rest on some demonstrated need rather than on a judgmental basis. Third, Gross Vehicle Weight (GVWR) serves no useful purpose in passenger car testing, and the design of systems to meet such testing will result in undesirable effects on driver control at normal weight. Finally, some of the early requirements surpassed the known state of the art, while other requirements represent, at best, modest improvements at substantial investment levels and cost to the consumer. Adequate brake system design still depends on the integrity of manufacturers and engineers. Ford undertook an engineering program to improve braking systems beyond the existing state of the art. Changes were made in passenger cars to comply with FMVSS 105-75. Several complete FMVSS 105-75 vehicle brake tests were conducted on each of Ford's 45 individual braking system and car line combinations on its 1976 cars. From data generated on tire and vehicle testing, two computer programs were set up to use and calculate all vehicle parameters significant to vehicle braking dynamics. Problems arose in testing. Using test drivers was essential, but because of uneven results driver performance was found an improperly essential factor in FMVSS testing. To meet the standard 200-lb effort in 0.08 second, test drivers sometimes applied over 300 lbs of pedal effort for the remainder of the stop. This results in a significantly more severe punishment of the brake system than is necessary. Finally, even with the aid of computers, the process of determining the "worst" adverse combinations of wheel base, suspensions, and option weights, is a long and expensive one. FMVSS 105-75 has affected industry and customers. Past brake system objectives were safety, noise, wear, reliability, fade resistance, balance, and customer satisfaction. Because these have been replaced by FMVSS 105-75 performance requirements, overhead costs have increased dramatically along with the training and specialization requirements of the test drivers. For the customer, brake improvements will have occurred through industry effort in spite of FMVSS 105-75, and higher cost and lower parking brake and service brake efforts will result.

by Carl Ballard; Ron Andrade
Ford Motor Co.
Rept. No. SAE-760216; 1976; 11p 5 refs
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-020 027

A CRITICAL REVIEW OF FEDERAL MOTOR VEHICLE SAFETY STANDARD 105

The present Federal motor vehicle standard, FMVSS 105-75, is inadequate. A meaningful and safety-related braking standard must be developed to provide that the elements of a brake system are addressed separately. The major elements of a safety standard must relate to specified performance levels of braking effectiveness, braking efficiency, response, controllability, and thermal effectiveness. The present standard has several weaknesses. Stopping distance is an inadequate measure of braking performance as it depends as much on driver use of the system as on the system itself. Partial failure requirements on service brake performance appear to be based largely on engineering design considerations and not accident facts. Since no specific information is available indicating that the method of arriving at increased temperatures has an effect on faded braking performance, different procedures for brake heating should be considered. Finally, parking brake performance, presently based on high levels of parking per-

formance, might better be conceived as an effective means of providing backup for the dual brake system in emergency stopping. Revision of the present standard must be drafted to apply to both new and in-use vehicles, to remove those elements not bearing upon highway safety, to stimulate safety-oriented advances in brake system design, and to provide that conformity can be accomplished without large testing facilities and skilled manpower.

by Rudolf Limpert
University of Utah
Rept. No. SAE-760217; 1976; 10p 10refts
Presented at Automotive Engineering Congress and
Exposition, Detroit, 23-27 Feb 1976.
Availability: SAE

HS-020 028

INTERIOR SAFETY OF AUTOMOBILES. ROAD TRAFFIC ACCIDENTS AND THEIR CONSEQUENCES. A STUDY BY GERMAN MOTOR TRAFFIC INSURERS ON 28,936 CAR CRASHES WITH PASSENGER INJURY

Analyses of individual injuries suffered and their respective causes were carried out on 50,464 automobile occupants injured while traveling in one of 28,936 vehicles not causing the accident. The individual injuries were classified according to severity, type, and location following the internationally accepted abbreviated injury scale (AIS). This and all data are presented in table form. Injury producing accidents were subjected to detailed analyses in relation to accident situation and speeds involved. Of the accidents under consideration, 62% occurred in urban traffic where collisions at intersections were preponderant with a proportion of about 49%. Data show that occupants not using their seat belts were exposed to an elevated risk of injury even at relatively low speeds. Three general accident types were recorded: oncoming traffic accidents; accidents at intersections; and rear end collisions. The death rate for oncoming traffic accidents goes up by a factor of four when compared to the other types. In frontal collisions with passenger injury, the left side of the front of the vehicle is very often damaged (59.9%). The left side is damaged twice as often as the right side in these accidents. The front seat passenger is exposed to the highest risk of injury of any occupant of the vehicle. Rollover of the vehicle represents 8% of traffic accidents as a whole, with generally minor injuries resulting to occupants. Vehicles catching fire following collision are found in only 0.2% of the accidents studied, but severe injuries were noted in these cases. Vehicles of differing mass were examined and it was found that deceleration is higher in the case of passengers in small vehicles; therefore, they are exposed to an elevated risk of injury as compared to passengers in heavier vehicles. Survey results have shown that, frequently, automobiles involved in extremely serious accidents and those with rollover were carrying more than 1.7 persons per car. An evaluation was also made of collision damage to various vehicle parts and the resulting passenger injuries. The percentages for frequently occurring damage are as follows: windshield 25%; instrument panel 23.7%; steering column 11.2%; steering wheel 29.1%; and front seats torn free 11.1%. These percentage shares cannot be compared directly to those of injury causes, since the yielding structure of some parts helps to avoid occupant injury. Studies on the effectiveness of seat belts have proven unequivocally that seat belt usage reduces the risk of fatal injury by at least 30%, and more probably by 50%. Photographs are appended which de-

pict the five degrees of vehicle damage used by the German Automobile Insurers.

German Assoc. of Third-Party Liability, Accident and Motor
Traffic Insurers (HUK-Verband), Hamburg, Germany
1975; 128p 19refts
Availability: Corporate author

HS-020 029

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM. COUNSELING AND REHABILITATION

A manual prepared for the State of Pennsylvania concerning the management, treatment, and rehabilitation of driving under the influence of alcohol or controlled substances (DUI) offenders is presented. An overview of the DUI problem states that, of 52,000 highway deaths recorded in 1972, nearly 50% were alcohol related. Narrowing of the visual field, lowered resistance to glare, and a decrease in sensitivity to the color red are noticeable effects of high blood alcohol levels. Psychological factors in the drinking/driving problem include the loss of necessary emotional control, the self destructive impulse, the reduction of inhibitions, and the alteration of self perception and confidence. A combined legal/mental health approach is suggested for the management of drunken drivers as an alternative to punishment. Considerations for treatment and rehabilitation personnel include the diagnosis and evaluation of the individual's drinking pattern, personality profile, and general lifestyle. Evaluation instruments available include the Mortimer-Filkins Test, the Michigan Alcoholic Screening Test (MAST), the Short Michigan Alcoholic Screening Test (SMAST), the National Council on Alcoholism Criteria for the Diagnosis of Alcoholism, and the Johns Hopkins Alcoholism Screening Test. Some additional evaluative indicators are: blood alcohol concentration (BAC); previous arrest record; self admission of loss of control over alcohol consumption; and previous treatment for alcoholism. Staff persons selected to evaluate DUI clients should have received basic training in the areas of alcohol abuse, alcoholism, and highway safety, should possess reading, writing, and sufficient mathematical skills and verbal communication abilities to prepare reports, should be empathic and sensitive to the population served, and be sensitive to the need for record confidentiality. The three major sections of the summary report to be compiled after completion of the evaluation interview and assembly of relevant informational elements are: a diagnostic description of suspected degree of alcoholism; a profile of the offender; and recommendations for follow up and disposition. Several approaches to treatment are recommended and defined: group therapy; individual therapy; family/couples therapy; disulfiram (Antabuse) therapy (a medication which acts as a deterrent to the use of alcohol); and chemotherapy. Recommendations for countermeasures program development include providing appropriate training for Alcoholism Treatment personnel and an alcoholic treatment program providing continuity of care from judicial, probation and parole, and educational components, one closely allied to existing alcohol and general health care delivery systems. A strong recommendation is put forth for the creation of a specific training program involving multidisciplinary components. A brief review is provided of past and present DUI countermeasures. Some future countermeasures which are presented include: mandatory disulfiram therapy for repeat or resistant offenders; increased use of weekend or evening incarceration; extensive use of Accelerated Rehabilitation Disposition (ARD); and use of sophisticated breath analysis techniques. A flowchart is provided

which illustrates a fully functioning, comprehensive countermeasures program in Pennsylvania. Appendices provide: additional reading material on clinical/diagnostic information; general alcohol related references; treatment resources in Pennsylvania; and Pennsylvania Motor Vehicle Code Related to Drinking and Driving.

by Pascal Scoles; Eric W. Fine; Michael J. Mulligan; Mary Miller
International Alcohol and Mental Health Associates, Inc.,
Philadelphia, Pa.
Contract 6-3113; PA-DOT-AL-76-10-4
1976; 38p 21refs
See also HS-020 030--HS-020 033.
Availability: Corporate author

HS-020 030

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM. ENFORCEMENT

A manual is presented which is designed to enhance the development of skills in detecting, apprehending, and gathering evidence for prosecution of persons driving under the influence of alcohol or controlled substances (DUI). The effects of blood alcohol level on the ability to drive are briefly described. The brain is most significantly affected by alcohol. Discrimination, insight, memory, concentration, and perception are dulled. Enforcement of DUI laws are difficult because of the wide acceptance of alcoholic beverages but penalties following conviction are usually severe. The multiplying impairment associated with drug/alcohol combination is known as synergism. Definitions are provided for narcotics, barbiturates and tranquilizers, amphetamines, and antihistamines. Some disorders which may resemble alcoholic intoxication are diabetes, epilepsy, head injury, high blood pressure, mental conditions, brain tumors, brain abscesses, brain infections, stroke or apoplexy, degenerative diseases of the brain and nervous system, uremia, Wernicke's Syndrome, and carbon monoxide poisoning. Elements of a DUI arrest are provided and include a description of the 1976 Pennsylvania definition of DUI as a third degree misdemeanor. An arresting officer must prove that the suspected person was either driving, operating, or in control of the vehicle, and that he/she was under the influence of alcohol or controlled substances sufficient to impair driving ability. For conviction, it is often only necessary for a driver to be in physical control of a vehicle. Being "in legal control" of a vehicle is being in a position to regulate movement of a car, whether the driver is actually doing so or not. Methods of observation and interrogation to be employed by the arresting officer are reviewed. The roadside sobriety examinations include the finger to nose test, the modified position of attention test, the heel/toe test, walking a line, standing on a line, pronunciation test, and dexterity test. Chemical testing for intoxication can be divided into two categories: those permitting an immediate analysis, and those requiring a subsequent laboratory analysis (usually concerned with specimens of blood and urine). In the Pennsylvania Uniform Vehicle Code, the legal presumptions based on chemical tests are as follows: 0.10% or more BAC is prima facie evidence of DUI; 0.05-0.10% - no presumption is made but will be considered in conjunction with other evidence substantiating alcohol influence; 0.05 or less is presumptive evidence of not being under the influence of alcohol. Types of chemical testing equipment are described. For the breath test two types of equipment are authorized in Pennsylvania. "A" type equipment includes the Albreath-Model 100. Alco Analyzer, and the Alcometer. With "B" type equipment such

as the Forrester Intoximeter and the Mobat Sober-Meter-Model 2, the operator makes a determination of the alcohol content of the blood. The blood test and urine test are described. Criteria for the selection of an appropriate chemical test are given, and the rights of the suspect are provided. The duties and responsibilities of the officer in court are described and some questions frequently asked of the officer in direct examination are listed. A flowchart is provided which illustrates a fully functioning, comprehensive countermeasures program in Pennsylvania. Appendices provide: general alcohol related references; and Pennsylvania Motor Vehicle Code Related to Drinking and Driving.

by Pascal Scoles; Eric W. Fine; Michael J. Mulligan; Mary Miller
International Alcohol and Mental Health Associates, Inc.,
Philadelphia, Pa.
Contract 6-3113; PA-DOT-AL-76-10-4
1976; 46p 28refs
See also HS-020 029 and HS-020 031--HS-020 033.
Availability: Corporate author

HS-020 031

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM. JUDICIAL

A manual is designed to inform the Court of recent developments which create new dispositional options for the person charged with driving under the influence of alcohol or controlled substances (DUI). An overview of the DUI problem states that, of 52,000 highway deaths in 1972, nearly 50% were alcohol related. The effects of blood alcohol level on the ability to drive are briefly described. Narrowing of the visual field, lowered resistance to glare, and a decrease in sensitivity to the color red are noticeable effects of high levels. The effects of alcohol in reducing inhibitions, altering self perception and self confidence, and changing attitudes and value judgments are as important to alcohol related accidents as the loss of psychomotor function. To manage drinking drivers, it is suggested that a combined legal-mental health approach would be a viable alternative to the forms of punishment which seem to cause more episodes of the deviant behavior. The three major sections of the summary report to be compiled after completion of the evaluation interview and assembly of relevant information are: a diagnostic description of suspected degree c alcoholism; a profile of the offender; and recommendation for followup and disposition. Several approaches to treatment are recommended and defined: group therapy; individual therapy; family/couples therapy; disulfiram (Antabuse) therapy (a medication which acts as a deterrent to the use of alcohol); and chemotherapy. Any treatment program for DUI offenders should be an integral part of a total system under the control and leadership of the courts. Some future countermeasures include: mandatory disulfiram therapy for repeat or resistant offenders; increased use of weekend or evening incarceration; extensive use of Accelerated Rehabilitative Disposition (ARD); and use of sophisticated breath analysis techniques. A flowchart is provided which illustrates a fully functioning, comprehensive countermeasures program in Pennsylvania. A listing of the key provisions of the 1976 Amendments to the Pennsylvania Motor Vehicle Code Regarding DUI Offenses is provided. Section 3731 defines the offense as a third degree misdemeanor and a combination of alcohol and drugs rendering a person unable to drive is specifically described. Penalties are set at fines up to \$2,500 and one year in prison for an offense. A habitual offender is defined as any person thrice convicted of DUI within a five year period, and is subject to an

automatic five year license revocation. A description is presented of the educational program concerned with the problems of alcohol and driving which has been set up in Pennsylvania. The role of the legal system with respect to the DUI offender is presented. The prosecutor can opt not to prosecute the case, dismissing it conditionally to the use of ARD, he may suggest to the Court that rehabilitative treatment is in order or he may decide, because of the special conditions of the accused or weakness of the evidence, not to prosecute at all. The defense attorney may serve his client's best interests by suggesting treatment as part of the sentence. Factors are presented which should be considered in deciding if a case is appropriate for an ARD disposition. Creative sentencing would include incarceration on weekends or evenings so that the offender will not lose his job thus compounding the problems which cause him to drink. A list of general alcohol related references is appended.

by Pascal Scoles; Eric W. Fine; Michael J. Mulligan; Mary Miller
International Alcohol and Mental Health Associates, Inc.,
Philadelphia, Pa.
Contract 6-3113; PA-DOT-AI-76-10-4
1976; 33p 36refs
See also HS-020 029, HS-020 030, HS-020 032, and HS-020 033.
Availability: Corporate author

HS-020 032

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM. LOCAL OFFICIALS

An overview of the driving under the influence of alcohol or controlled substances (DUI) problem states that, of 52,000 highway deaths in 1972, nearly 50% were alcohol related. The effects of blood alcohol level on the ability to drive are briefly described: depression of inhibitory control mechanisms, dulling of discrimination, insight, memory, concentration, and perception, diminution of physical abilities, narrowing of the visual field, impairment of resistance to glare, and decrease in sensitivity to certain colors, particularly red. The effects of alcohol in reducing inhibitions, altering self perception and self confidence, and changing attitudes and value judgments are as important to alcohol related accidents as the loss of psychomotor function. To manage drinking drivers, it is suggested that a combined legal-mental health approach would be a viable alternative to the forms of punishment which seem to cause more episodes of the deviant behavior. Staff persons selected to evaluate DUI clients should have received basic training in the areas of alcohol abuse, alcoholism, and highway safety, should possess reading, writing, and sufficient mathematical skills and verbal communication abilities to prepare reports, should be empathic and sensitive to the population served, and be sensitive to the need for record confidentiality. The three major sections of the summary report to be compiled after completion of the evaluation interview and assembly of relevant information are: a diagnostic description of suspected degree of alcoholism; a profile of the offender; and recommendations for followup and disposition. Recommendations for countermeasures program development include providing appropriate training for Alcoholism Treatment personnel and an alcoholic treatment program providing continuity of care from judicial, probation and parole, and educational components, one closely allied to existing alcohol and general health care delivery systems. A brief review is provided of past and present DUI countermeasures. Some future measures which are presented include: mandatory disulfiram therapy for

repeat or resistant offenders; increased use of weekend or evening incarceration; extensive use of Accelerated Rehabilitative Disposition (ARD); and use of sophisticated breath analysis techniques. A flowchart is provided which illustrates a fully functioning, comprehensive countermeasures program in Pennsylvania. The county official serves the dual function of initiator and implementor of programs designed to protect society from the drunk driver. As a minimum the counties must set up an Educational Safe Driving School directly related to the courts. A 16 hour, eight session course specially designed for the needs of a drunk driving offender has been developed by Pennsylvania and its adoption in each county statewide is recommended. Although the overall costs of a comprehensive DUI countermeasures program appear to be high, two considerations should be kept in mind, the bulk of new services should be largely self-supporting, and the potential benefit to the citizens could be profound in human and budgetary terms. Appendices include: Pennsylvania Motor Vehicle Code Related to Drinking and Driving; general alcohol related references; and a listing of treatment resources in Pennsylvania.

by Pascal Scoles; Eric W. Fine; Michael J. Mulligan; Mary Miller
International Alcohol and Mental Health Associates Inc.,
Philadelphia, Pa.
Contract 6-3113; AL-76-10-4
1976; 29p 26refs
See also HS-020 029--HS-020 031 and HS-020 033.
Availability: Corporate author

HS-020 033

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM. CURRICULUM AND INSTRUCTOR'S GUIDE

Lesson plans and class content are given in a teacher's manual for a 16-hour course of instruction designed for persons arrested for drunk driving. For each of the eight two-hour classes, the lesson plan gives the specific topic, general objective, specific objectives, course content, methods of presentation, materials needed, and questions to use in discussion and review. The subjects of the lessons are the following: introduction to the Pennsylvania Alcohol Highway Safety Program, effects of alcohol on the human body, nature and scope of the drinking-driving problem, drinking and driving patterns, the problem drinker and alcoholism, alcoholism and family disruption, alcoholism and the individual, and a review session. The course material presents a negative bias towards drinking and towards combining drinking with driving, particularly in the films: factual material is presented in a straightforward manner, however. Since the goal of the course depends on minimal student anxiety and defensiveness, the teacher's classroom strategy should be to present himself as a non-judgmental person who is open towards the students. He should also make good use of group dynamics to encourage the learning experience. Appendices deal with course evaluation, treatment resources in Pennsylvania, audiovisual resource material, a bibliography, and a reference list of rele-

joint judicial, law enforcement, counseling and rehabilitation, and county personnel.

by Pascal Scoles; Eric W. Fine; Michael J. Mulligan; Mary Miller
International Alcohol and Mental Health Associates Inc.,
Philadelphia, Pa.
Contract 6-3113; PA-DOT-AI-76-10-4
1976; 90p 49refs
Cover title: Curriculum and Instructor's Guide for the
Commonwealth of Pennsylvania's Alcohol Highway Safety
Program. See also HS-020 029--HS-020 032.
Availability: Corporate author

HS-020 034

TWO-STAGE DESIGN AIDS EMISSION RESEARCH

Two-stage combustion is currently being investigated in the search for pollution control of the internal combustion engine. With this combustion, a rich mixture is ignited in a first-stage cylinder and its combustible rich gases are fed, with additional air, into a second-stage cylinder for recombustion. The concept's attractiveness lies in its inherent control of oxides of nitrogen (NOx). If, however, the second-stage temperature is insufficient to support complete combustion, then carbon monoxide (CO) oxidation is hampered and its output soars. Also, incomplete combustion can generate higher hydrocarbon (HC) output. This process was investigated both theoretically and through operation of a Cooperative Fuel Research (CFR) single-cylinder engine. First, researchers monitored the single-cylinder CFR engine in the rich mode. Then this output was simulated by an auxiliary combustion, and the product stream was used to fuel the lean, second-stage mode of operation. By combining results from both phases, actual simulation of the two-stage operation was possible. It was found that NOx control is relatively insensitive to equivalence ratios (ER's), both those of the simulated first stage and of the total system. Researchers feel that HC increase with decreasing system ER is caused by incomplete combustion under conditions of lower temperature. At the system of ER's of interest (0.9-1.0 range) HC output is low. CO output is more sensitive to system ER: even in the optimal range of system ER (0.90-0.95), it appears doubtful that CO emission would meet the proposed standard of 3.4 g/mi. Higher energy ignition and increased turbulence, however, may improve matters.

Publ: Automotive Engineering v84 n12 p26-30 (Dec 1976)
1976
Based on SAE-760759 and presented at Automobile
Engineering and Manufacturing Meeting, Dearborn, 18-22 Oct
1976
Availability: See publication

HS-020 035

JOINING DISSIMILAR METALS WITH TRANSITION MATERIALS

A method of joining dissimilar metals has been developed, involving the use of transition materials. Using the steel-aluminum system as an example, the joining problems associated with the formation of brittle intermetallics during welding can be avoided. The joining is accomplished through the use of a steel-clad aluminum transition material so that steel-to-steel and aluminum-to-aluminum welds are formed. Since dissimilar metal crevices are avoided by this technique, galvanic corrosion is minimized. This method allows the joint to occur at the

bond interface of the clad transition material, eliminating dissimilar metal welds, crevices, and associated corrosion problems. This joining method is applicable to a wide range of dissimilar metal combinations with applications on automobiles, including areas where weight reduction, strength, and corrosion resistance are required and involve the use of inserts, clips, and fasteners, or molten metal techniques.

Publ: Automotive Engineering v84 n12 p32-5, 65 (Dec 1976)
1976
Based on SAE-760714 by Robert Baboian and Gardner S. Haynes and presented at Automotive Engineering Meeting, Dearborn, 11-15 Oct 1976.
Availability: See publication

HS-020 036

DESIGNING EXHAUST PORTS FOR LOW HEAT TRANSFER

To obtain more efficient processing of combustion products, before atmospheric release, it is necessary to identify and evaluate the parameters of exhaust port design that affect heat transfer to the engine coolant: port size and shape, insulation methods and valve design geometry. Experiments were conducted on a 50 CID single cylinder engine built on a modified 400 CID V8 engine block. The cooling system of the fixture head was designed to be completely separate from the engine cooling system. Exhaust ports with widely varying configurations could be accommodated on the exhaust side of the jacket. The exhaust system was tested with a variety of insulations. Five geometric parameters were varied: turn angle, port length, port cross sectional area, shape factor, and throat diameter. Results showed that a significant heat loss reduction in the exhaust port can be obtained with proper design: a 26% reduction being obtained without a liner and an average 39% reduction being found with an air gap relative to the baseline configuration. This is significant not only in terms of increased exhaust gas temperature in the manifold/reactor, but also in terms of reduced cooling system load. Multi-cylinder heat transfer data, when compared with single cylinder data from this study, indicate that a 20% reduction in cooling requirements is possible and could result in decreased cooling system cost and weight. With this large a reduction in cooling system load, using port liners without the associated change in the cooling system could result in long warm-up time for a vehicle. The resultant benefit in hydrocarbon (HC) and carbon monoxide (CO) emissions may not be achieved with this system. Further work is being performed with special concern being focused on incorporating a liner into the freeflow design, liner coverage of the valve guide, push-in liners, insulating the contact areas of a cast-in liner, and improved insulating materials.

Publ: Automotive Engineering v84 n12 p40-3 (Dec 1976)
1976
Based on SAE-760766 by James H. Rush, Ford Motor Co. and presented at Automotive Engineering Meeting, Dearborn, 11-15 Oct 1976.
Availability: See publication

HS-801 982

EMERGENCY MEDICAL SERVICES. A BIBLIOGRAPHY

A bibliography is presented of literature acquired since the establishment of the National Highway Traffic Safety Ad-

ministration in 1967, as related to emergency services on the highway. Citations follow the format used in the monthly abstract journal Highway Safety Literature and are indexed by a key-word-out-of-context or KWOC listing, author, corporate author, contract number, and report number. Availability is given in the individual citations.

by Lois Flynn, comp.
National Hwy. Traffic Safety Administration, Technical Services Div., Washington, D.C. 20590
Rept. No. SB-07; 1976; 216p
Availability: NTIS

HS-801 988

SAFETY BELT USAGE. A REVIEW OF EFFECTIVENESS STUDIES. SUGGESTIONS FOR STATE PROGRAMS

A review of effectiveness studies and suggestions for State programs with regard to safety belt usage are presented. The National Highway Traffic Safety Administration (NHTSA) estimates that lap belts are 40% effective in preventing crash related deaths, while lap/shoulder combinations are 60% effective. With regard to injuries, based on a 1976 study by Reinhardt, Silva and Hochberg, the NHTSA estimates that lap belts are 31% effective in preventing moderate to critical injuries, while lap/shoulder combinations are 57% effective. The most important of the effectiveness studies are summarized chronologically. With regard to cost-effectiveness, it is pointed out that safety belts have the lowest cost (\$506) per fatality prevented. Overall safety belt usage during 1975 was about 11% for lap belts and 9% for lap/shoulder combinations. Australia is discussed in relation to its safety belt usage record (For 1974, out of 3,100 motor vehicle fatalities, about 600 lives were saved as a result of safety belt usage). States can work toward increasing seatbelt usage by enacting usage laws, and by informing the public on the efficacy of usage based on accident reports giving statistics on lives that might have been saved had belts been used. An appendix presents a mathematical procedure for derivation of estimated number of lives saved by safety belt usage.

National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Programs, Washington, D.C.
1976; 15p 14refs
Availability: NHTSA

HS-802 033

MULTIDISCIPLINARY ACCIDENT INVESTIGATION. VOL. 1. FINAL REPORT

Twenty-five fatal and twenty-five nonfatal vehicular accidents occurring in the Baltimore, Md. metropolitan area 28 Jun 1974-30 Jun 1975 were investigated using vehicle and scene examinations, autopsy findings, injury reports, toxicological data, and psychosocial evaluation with particular emphasis on the human factors aspect of the accident. Of the 25 fatal accidents, 60% were multiple vehicle accidents; all culpable drivers in the accidents, with the exception of one, were males. The median age bracket for the fatally injured driver was 16-20 years. Saturday, Sunday and mid-week revealed the highest incidence of fatal accidents per day of week; 68% of the fatalities occurred between 4:00 p.m. and 4:00 a.m. Ten of the 25 fatal accidents were vehicle/fixed object, nine were vehicle/vehicle/intersection; five were vehicle/vehicle/median

crossover and one was a vehicle/train impact. Consumption of alcohol and its effect upon the vehicle operator was regarded as a primary factor in the causation of 44% of the fatal accidents. Decision error by the driver was considered responsible for 20% of these accidents. Excessive speed and perception/comprehension error by the driver were the most frequent contributory factors in the accident causation. In the 25 nonfatal accidents investigated, perception error by the driver (32%) and decision/action error by the driver (28%) ranked as the most frequent primary causative factors. Alcohol was a contributing accident causation factor in 28% of the nonfatal accidents. In the group of 25 fatal accidents involving 31 drivers and passengers killed, restraints were not utilized by any of the 26 drivers or five passengers fatally injured. Restraints (lap, upper torso, or both) were installed in all but one of the vehicles where a fatality occurred. The lives of at least 14 of the 26 drivers and three of the five passengers would have been saved if restraints had been used. The majority of the fatal injuries were located in the head, chest, or abdomen. Instrument panels and side interiors represented the primary areas of impact. In six of the 25 fatal collisions and one of the 25 nonfatal collisions, the nonrestrained occupants were ejected and sustained their injuries from ground impact and other external objects. Of the current Federal Safety Standards, Alcohol in Relation to Highway Safety, Highway Design, Construction and Maintenance, Driver Licensing and Periodic Motor Vehicle Inspection were mentioned as primary areas of negative citation. An investigation of 84 fatal and 71 nonfatal accidents occurring 1 Jan 1971-30 Jun 1975 showed that the most significant type of fatal collisions were those in which vehicles left the roadway, impacted fixed objects and/or rolled over, with collisions within intersections as the second most significant type, while the most significant type of nonfatal collision involved a vehicle leaving the roadway and impacting with a fixed object, with rear-end impacts as the second most significant type. Use of the restraint system would have prevented some fatalities and reduced the severity of some injuries. A multivariate statistical analysis of psychosocial and related data collected on male drivers from 1969 through 1975 showed that responsible male drivers involved in fatal or potentially fatal automobile crashes were not representative of the general population of male drivers, but that there were not significant differences between the fatally injured and the nonfatally injured. Alcohol abuse was strongly associated with serious automobile accidents, but its role as a causative factor remains to be demonstrated.

Maryland Medical-Legal Foundation, Inc., 111 Penn St., Baltimore, Md. 21201
Contract DOT-HS-198-3-770
Rept. No. MMF-FR-1974; 1976; 187p 6refs
Rept. for 28 Jun 1974-30 Jun 1975.
Availability: NTIS

HS-802 053

A REPORT OF THE WAVE II VS. WAVE I TRACKING STUDY. FINAL REPORT

Two waves of research were conducted to determine the public's awareness of the drunk driving problem, one taking place immediately prior to the launching of a campaign (radio, TV, and print communications), the other six months later. Specific strategic objectives were to increase people's awareness of potential DWI (Driving While Intoxicated) situations by educating on misperceptions, and to persuade ARS- (alcohol-related situations) involved individuals to take coun-

terminals. People were interviewed using a central location WATS (Wide Area Telephone System) line method designed to provide nationally projectable data. It was found that 85% of the people considered drunk driving an extremely or very important problem. ARS participation appears to be growing. Concern and awareness of the potential DWI situation are increasing (indicating the effectiveness of the advertising) with significantly more ARS-involved people who recall National Highway Traffic Safety Administration (NHTSA) advertising now discussing the issue of drunk driving (07% pts.) and recognizing themselves to be in potential DWI situations (06% pts.). There has been a significant increase in the number of people who now understand the myth of black coffee as a sobering agent and directional increases on the issue of the potency of beer and wine. The "likelihood" to take individual countermeasures are down among all ARS-involved who were actually in a potentially DWI situation, but the countermeasure was up (especially offering to let the person stay over). This specific countermeasure was the main focus of the TV production "Teddy." Among the ARS-involved, there is an increased awareness of anti-drunk driving communications from 69% to 75% but often related to previous (nonstrategic) messages rather than the new campaign (having reached 38% of those aware of any advertising). Detailed findings are presented in tabular form. The questionnaire used in the survey is given in an appendix.

Grey Advertising, Inc., 777 Third Ave., New York, N.Y.
10017
Contract DOT-HS-5-01220
Rept. No. Report 11400-601BS; 1976; 41p 2refs
Rept. for Aug 1975-Mar 1976.
Availability: NTIS

HS-802 056

A STUDY TO DETERMINE THE CAUSES OF ACCIDENTS: AN IN-DEPTH CASE REPORT CASE NO. TAC-SP-75-6, SCHOOL BUS/GARBAGE TRUCK--ACUTE OBLIQUE. FINAL REPORT

An in-depth, multidisciplinary report is given for an accident in which a school bus carrying 49 children, on a morning with limited visibility (fog), hit the rear of a garbage truck which was stopped and positioned obliquely in the bus's traffic lane. A case summary gives the conditions surrounding the accident: descriptions of the vehicles involved and their damage; descriptions of the passengers and their injuries; Federal Motor Vehicle Safety Standards (FMVSS) and Highway Safety Program Standards (HSPS) relevant to the case; and pre-crash, crash and post-crash descriptions of events. Sections of the report are devoted to the following aspects of the case: causal factors and conclusions, recommendations, human pre-crash phase, human crash phase, human post-crash phase, vehicle pre-crash phase, vehicle crash phase, vehicle post-crash phase, and environment pre-crash phase. Appendices contain photographs, driver records, seat back tests, proposed rules, lamp status analysis, police report, film slide index, and collision and injury report.

by Nicholas S. Tumbas; Hobart M. Nay; John E. Pless; Robert A. Romberg; Rickey L. Stansifer; John R. Treat
Indiana Univ., Inst. for Res. in Public Safety, 400 East Seventh St., Bloomington, Ind. 47401
Contract DOT-HS-034-3-535
Rept. No. TAC-SP-75-6; 1976; 144p
Rept. for Oct 1975.
Availability: NTIS

LORAN-C FEASIBILITY DEMONSTRATION PLAN. FINAL REPORT

In order to demonstrate terrestrial applications of LORAN-C, a radio navigation system operated and maintained by the U.S. Coast Guard, it is recommended that one determine the need for and costs of calibrating and of converting LORAN-C time difference values to other site location forms, determine the control display requirements as a function of system application and the costs and problems involved in training users, list the steps required to implement a LORAN-C system in each of the application areas, list operational difficulties, and document the costs of implementation of a LORAN-C system. It is recommended that the demonstration be conducted on a cluster sample basis since this would be less costly and probably more acceptable to the participating agency than total conversion to a LORAN-C system and it would provide a sample of simultaneous operations with and without the LORAN-C system for comparison. Evaluation criteria should be outlined before the demonstration. Applications to be demonstrated are distributed in three major categories: Automatic Vehicle Monitoring (AVM), Automatic Vehicle Location (AVL) or Dispatch, and Site Registration, and include uses by police, emergency service, and highway and transportation agencies. The work steps involved in this demonstration are coordination with the participating agency and familiarization with the operations of the applications to be demonstrated, calibration and cartography, detailing data requirements, preparing equipment criteria and procuring the equipment, preparing computer systems and programs, testing, debugging and installing equipment, training the participants in the use of the equipment and in the use of the LORAN-C, data collection before and during the demonstration, data reduction and analysis, validation and report preparation. Approximate costs and man-day requirements for these steps have been calculated. Tabulated information is given on an estimated project budget: itemized estimated costs to perform work steps, and LORAN-C demonstration schedule activities.

New York State Dept. of Motor Vehicles, Traffic Records Proj., Empire State Plaza, Albany, N.Y. 12228; Polhemus Navigation Sciences, Inc., Burlington, Vt. 05041
Contract DOT-HS-3-01234
1976; 46p
Rept. for Jul 1975-Aug 1976.
Availability: NTIS

HS-802 058

DEVELOPMENT OF ADVANCED TRAFFIC ADJUDICATION TECHNIQUES. FINAL REPORT

A special office of the contractor was established in Denver, Colo. to handle correspondence on traffic adjudication practices with Annette Finesilver as Project Director; extensive correspondence with many states and individuals has been conducted. A list of National Experts in traffic adjudication was prepared and a primer entitled "New Trends in Advanced Traffic Adjudication Techniques" was developed and has been widely distributed by NHTSA. Three workshops were conducted on Advanced Traffic Adjudication Techniques: Jan 1975, the Western Advanced Adjudication Workshop in Seattle, Wash.; Apr 1975, the Mid-Atlantic Workshop on Advanced Traffic Adjudication Techniques in Baltimore, Md.; and Dec 1975, the Mid-Western Conference on New Trends in Traffic Adjudication in Kansas City, Mo. A newsletter, Traffic

Safety Adjudication Reports, has been developed and successfully received. Recommendations for continued activity include wide distribution of the primer with accompanying information on the willingness of NHTSA to give assistance to jurisdictions; quarterly distribution of the newsletter; and continuation of the workshop program, perhaps on an individual-state basis rather than a multi-state basis. Appendixed are a sample of a workshop agenda and samples of bulletins and newsletters.

M. H. Wagner and Co., 9128 Christopher St., Fairfax, Va. 22030
Contract DOT-HS-4-01000
1976; 38p
Availability: NTIS

HS-802 084

PROBLEM IDENTIFICATION MANUAL FOR TRAFFIC SAFETY PROGRAMS. VOL. 1

Problem identification is defined as the collection of data (traffic records), and its accumulation in sufficient quantities for a valid statistical analysis, which is used in increasingly detailed comparisons until subpopulations are identified which are over-represented in highway accidents and other safety problems. One source of data available to nearly all jurisdictions is the traffic record systems file, including driver record, vehicle registration, roadway file, and accident file. Other records, available in some states, are emergency medical services, enforcement and adjudication, educational services, and highway safety management files. The potential users of this problem identification system are governments at all levels: Federal, State, County, and City. Among the Federal agencies to benefit are NHTSA, its regional offices, and the Federal Highway Administration. State agencies which could benefit from the program are the Governor's Representative for Highway Safety Programs (GHSR), regional programs within states, Departments of Motor Vehicles, Highway Departments, State law enforcement agencies, Departments of Education, and Emergency Medical Services (EMS). At the county level, County Roads Departments and law enforcement agencies could benefit from the program. Some cities are being delegated responsibility and authority for their own traffic safety and may submit Annual Work Plans for specialized programs through the office of the mayor or city manager. All cities have departments corresponding to those at the State level, such as police, roads and emergency services, which could similarly benefit from the problem identification system. The problem identification process occurs at two levels. At Level 1, the general problem areas are isolated by three basic steps: identification and availability of traffic records information, listing of reports to be submitted regularly, and developing of a method to determine over-representation of certain groups with corresponding identification of possible problem areas. At Level 2, there is a continuation of the refinement process which studies specific populations and subpopulations, defining exactly where, when, and how problems are occurring. There are four steps in the Level 2 process, all to be taken in connection with the general problems identified at Level 1. These steps include: identification of files for relevant information, identification of potentially useful data elements, listing of the univariate frequencies of these data elements, and performing detailed analyses to identify all dimensions of the specific problem. To insure that the decisions made as a result of these steps in problem identification are valid, it is essential to use appropriate procedures for the collection, anal-

ysis, interpretation and presentation of data. All of this involves the principles of statistical analysis, and requires, due to the high volume of data involved, the use of computers, which have the advantage of speed, low cost, and high accuracy. Computers, when programmed for the appropriate purpose, will accept two types of commands: statistical and processing. Statistical commands include single variable frequency distributions, scatter diagrams, measures of central tendency, measures of dispersion, and regression analysis. Processing commands allow data to be sampled from a population, weighted by importance, labelled for each category, selected by various criteria, and grouped according to homogeneous features.

National Hwy. Traffic Safety Administration, Office of State Program Assistance, Washington, D.C. 20590
1976
Vol. 2 is HS-802 085.
Availability: NHTSA

HS-802 085

PROBLEM IDENTIFICATION MANUAL FOR TRAFFIC SAFETY PROGRAMS. VOL. 2. MODEL REPORTS

As a part of the problem identification process, statistical reports should be generated to satisfy the information needs of highway safety management personnel. These reports will usually be generated on a "need" basis. However, a number of model reports that depict well-known and recurring problem areas and some further reports that can be utilized to identify problems in multiple areas have been included. These model reports are by no means the only reports that should be generated, but represent a small sample of potentially useful reports that can be used as a starting point in report generation. The "two-way" tables discussed here belong to a larger class called contingency tables or crosstabulations. In "two-way" tables there are two data elements involved; there may be three-, four-, or N-way tables, where N is the number of data elements. The same rules apply to tables of all numbers of data elements.

National Hwy. Traffic Safety Administration, Office of State Program Assistance, Washington, D.C. 20590
1976; 121p
Vol. 1 is HS-802 084.
Availability: NHTSA

HS-802 107

ELECTROMAGNETIC INTERFERENCE EFFECTS ON MOTOR VEHICLE ELECTRONIC CONTROL AND SAFETY DEVICES. FINAL REPORT. VOL. 1 - SUMMARY

As a part of the Dept. of Transportation's Road Vehicle Electromagnetic Compatibility/Electromagnetic Interference (EMC/EMI) program, a computerized coupling analysis program was used to determine the effects of body shielding, aperture size, and cable lengths on signal coupling in the 100 to 200 MHz band between a simulated mobile radio emission and a modulated air-cushion restraint system cable as it might be used in a motor vehicle. The degree of coupling is more dependent upon the largest aperture dimension than upon the aperture area; a greater than 40 dB attenuation of signal was predicted due to cable shielding. A series of susceptibility tests

formed on an electronic speed control system and an accident control module determined functional upset levels of injected signals at critical circuit ports on these devices. Upset criteria are based on performance departures from normal, resulting from the injection of interfering signals. Injected signals are designed to represent levels and durations characteristic of those generated within the vehicle or coupled from external sources. Tabular displays are made of summaries of force and coupled signal waveforms and of field strengths in frequency ranges of electromagnetic fields encountered by automobiles under normal operating conditions. Guidelines for promoting EMC in the use of electronic control and safety systems in automobiles emphasize the need for coordination and integration of all aspects; they constitute Phase 2 of the project. Phase 3 should test functional units to support EMC management for design, system engineering, and normal maintenance phases. Testing and evaluation of special subsystems could also be considered. Research should deal with the feasibility of a central processor or control system for integrated electronics applications.

R. H. Espeland; D. H. Layton; B. D. Warner; L. R. Teters; L. Morrison, Jr.
Department of Commerce, Inst. for Telecommunication Sciences, Boulder, Colo. 80302
Contract DOT-HS-5-01097
1976; 24p 11refs
pt. for 1 Mar 1975-1 Jul 1976.
Availability: NTIS

6-802 114

MOTOR VEHICLE SAFETY SEMINAR. KEY ISSUES HEAVY TRUCK SAFETY. TRANSCRIPT OF PROCEEDINGS, JULY 12, 1976

Opening remarks included presentation of the Edward J. Gurnea Automotive Safety Award to Henry M. Wakeland and his response. Statistical data on heavy truck accidents as developed by the National Highway Traffic Safety Administration (NHTSA) were presented, which concern characteristics of accidents, their consequences, and comparison of large truck accident rates with other vehicle rates. Accident severity is high and increases with truck weight in truck collisions with other vehicles, 97% of the fatalities being non-truck occupants when a truck and passenger car are involved. The Motor Vehicle Manufacturers Association (MVMA) suggested that future safety research be concentrated in the areas of better accident reporting and evaluation procedures which distinguish between large and small trucks, of the development and maintenance of depth large truck accident studies, of police reporting and data collection techniques, of more effective truck inspection procedures, and of comprehensive driver training, registration and licensing procedures. The MVMA representative recommended an exchange of information among the government agencies, the public, the truck industry and the scientific community before regulations are promulgated. He further recommended using government vehicles in a program of truck research. NHTSA considered the government fleet inadequate for research purposes. Anthony L. Schmeig of the National Transportation Safety Board, citing a 1973 study of commercial vehicle braking, outlined the problem of the difference in stopping capabilities between passenger cars and commercial vehicles which has not improved in the last five years. Reluctance of manufacturers and carriers to accept major changes seems to be based on cost/benefit factors and the problem of maintaining interchangeability between tractors and trailers. The previously demonstrated high fatality rate for pas-

senger car occupants in truck-car accidents justifies the effort to raise truck braking to the performance levels of passenger cars. The International Brotherhood of Teamsters defended the trucking industry by challenging the NHTSA accident statistics, supported enforcement of equipment standards, and commented on recommendations made at an earlier presentation. There followed the transcript of a panel discussion on the statements and formal statements by several seminar attendees. Robert D. Ervin of the Highway Safety Research Institute reported new findings which suggested that the yaw stability of trucks and tractor trailers is relevant to truck safety. Ray W. Murphy of Freightliner Corporation suggested that accident avoidance techniques, improved driver skills and highway improvement are factors of great potential for highway safety, and that override protection on trucks should not be relied upon in accident prevention.

National Motor Vehicle Safety Advisory Council
1976; 238p

See also HS-802 115 and HS-802 116.

Availability: Alderson Reporting Company, Inc., 300 Seventh St., S.W., Washington, D.C.

HS-802 115

MOTOR VEHICLE SAFETY SEMINAR. RESTRAINT SYSTEM EFFECTIVENESS. TRANSCRIPT OF PROCEEDINGS, JULY 13, 1976

The second session of the motor vehicle safety seminar, concerning restraint system effectiveness, began with a statement about Ontario's experience with mandatory seatbelt legislation. The legislation was preceded by a massive public information program in schools, in the media and by public demonstration. The program was evaluated by telephone survey. The law was not enforced until a month after implementation, during which time warnings were used. The bill as originally passed was altered in response to criticisms, exemptions being granted for children under five years, for medical reasons, for drivers making frequent stops in the course of their employment, for some police officers, for persons in custody, and for vehicles built prior to 74-01-01. Enforcement is difficult. An evaluation of the law's effectiveness in the Robertson Report is thought to be misleading, and there are insufficient data for evaluation at the present time. Those who object to mandatory seatbelt use offer the following reasons (in order of frequency): loss of individual freedom, danger or injury by seat belts, nuisance value and discomfort. The nonbelted driver and passenger can endanger others. While seat belts can cause injuries unless worn properly, the injuries are less severe than for unbelted persons, and the dangers of imprisonment by seat belts have been grossly exaggerated. Air bags have been considered in Ontario but are expensive to install and to replace, and are not currently available. The Ontario Government concluded that no single action in the field of motor safety could produce results equal to those of the mandatory seatbelt law. The statement concerned the reasons why people consider seat belts uncomfortable, and reviewed the history of the development of the seat belt. Important factors in seatbelt design were comfort and convenience in donning and wearing, noninterference with driving and in egress, and convenience in doffing. Safety belt comfort and convenience can be substantially improved in geometry, in force factors, and in adaptation of the retractor system to the vehicle rather than the belt. SAAB discussed government interaction in belt usage effectiveness in Sweden. The automatic seat belt gives slightly better protection than the static type. American Safety Equipment Corp. presented

new developments in safety belt design for improved comfort and convenience and increased protection. The statement concurred with that of Mr. Woodson that the pressure of the shoulder belt is probably the most objectionable feature of the seatbelt, somewhat alleviated by the "Comfort Clip," the "Belt Tension Reliever" and the "Comfort Zone." Added protection can be provided by energy absorbing webbing and belt tighteners. A statement by NHTSA concerned field experience with both air bags and belt systems, based on data collected from 74-01 to 75-10, which involved the three-point belt system. The statements of the Ford Motor Co. concerned the problem of increasing seatbelt usage. The factors and constraints which influence the design engineer include functional performance, comfort and convenience, manufacturing feasibility and cost. Specifications of FMVSS 208, Occupant Crash Protection, interfere with the development of better seat belts and reminder systems. Collection of specialized demographic data on seat belt use, public education through a multimedia program including manufacturers' advertisements, and a reduction in the multiplicity of government safety specifications could lead to better restraint systems.

National Motor Vehicle Safety Advisory Council
1976; 179p

See also HS-802 114 and HS-802 116.

Availability: Alderson Reporting Company, Inc., 300 Seventh St., S.W., Washington, D.C.

HS-802 116

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY, POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

The transcript of the final session of a three-day seminar on public policy, politics and motor vehicle safety standards is presented. Dan Levin of the Senate Government Operations Committee speaks of Congressional action to reform Federal regulations. Since economic and social regulation by government has grown rapidly and become costly, there is increasing public criticism of the regulatory agencies. Reform proposals include further study, Congressional oversight and/or veto of regulations, phasing out of agencies, organizational change or regulatory reform plans, requirements of cost/benefit analysis, zero-base budget review, increase in reliance on antitrust laws with a consequent reduction in economic regulation, and use of the taxing authority or fines to pursue regulations' goals. A procedural approach is recommended, with a timetable for implementation of reform plans. Lowell Dodge, member of the House Subcommittee on Oversight and Investigation, discusses the use and misuse of benefit/cost analysis in rulemaking actions of NHTSA. The legislative history of the motor vehicle safety program is presented. Cost/benefit analysis has been brought to the fore because of the involvement of the Council on Wage and Price Stability in Federal rulemaking and Secretary Coleman's three regulatory reform policies of 76-04-13. The Subcommittee is assessing the appropriate role of cost/benefit analysis, its value to NHTSA rulemaking and its limitations. Cost/benefit analyses are often ignored, sometimes rightly so. Data for the costs side are elusive, and the benefits side is influenced by subjective judgments and hindered by difficulty of projecting benefits into the future. Admitting that cost/benefit analyses have limitations is recommended. As much cost data as possible should be obtained and benefits should be expressed in terms of avoidable or reduced injuries or fatalities. NHTSA should upgrade its data gathering

and analysis system, assess the impact of present standards and weed out useless ones. A panel discussion follows.

National Motor Vehicle Safety Advisory Council
1976; 51p

See also HS-802 114 and HS-802 115. Cover title: National Motor Vehicle Safety Council Meeting, July 14, 1976. Stenographic Transcript of Hearings.

Availability: Federal Data Retrieval Systems, Inc., 1755 South Jefferson Davis Hwy., Suite 1101, Arlington, Va. 22202

HS-802 117

NATIONAL MOTOR VEHICLE SAFETY ADVISORY COUNCIL MEETING, JULY 15, 1976. STENOGRAPHIC TRANSCRIPT OF HEARINGS

In the hearings following the National Motor Vehicle Safety Advisory Council seminar, Dr. Snow of NHTSA outlined his concerns about the expansion of the agency's mission, and about the public feeling that government regulations intrude upon personal freedom. He considered that the safety requirements have frozen advancement in safety technology to non-uniform practices and devices which were already available and have thereby impeded competition. He recommended the use of benefit cost analysis as a tool for evaluation of safety factors and greater involvement of the public sector in solving safety problems. Following discussion of the logistics of the next Council convention, Mr. George C. Nield raised an objection to the fact that consumer information on stopping distance, tire loading and acceleration was available from the Government Printing Office only at the end of the model year. The suggestion was made that publication of this information be discontinued if it could not be provided sooner. The main business of the meeting concerned the Council's position, to be presented by the Chairman Dr. B. J. Campbell, before the NHTSA 76-08-03 hearings on FMVSS 208, Occupant Crash Protection. Dr. Julian Waller proposed that the Council support the development of a passive restraint system, not exclusively limited to air bags, and implementation of mandatory seatbelt usage legislation as an interim measure until a reliable passive system is available. This represents a combination of the second and fourth of the five options described by the Secretary of Transportation. Dr. Waller further recommended that an overall history of the Council's position be presented as background. Dr. Harold A. Fenner, Jr. raised the question as to whether any new type of passive restraint system had to be crash tested before it could be accepted, a performance which has proved very time-consuming.

National Motor Vehicle Safety Advisory Council
1976; 103p

See also HS-802 114, HS-802 115, and HS-802 116.

Availability: Federal Data Retrieval Systems, Inc., 1755 South Jefferson Davis Hwy., Suite 1101, Arlington, Va. 22202

HS-802 121

RESEARCH SAFETY VEHICLE (RSV) CRUSH TEST REPORT

The Calspan/Chrysler Research Safety Vehicle (RSV) is being developed from a base car, the Simca 1307/1308, using lumped spring mass computer models in order to simulate various crash conditions. The force-deflection data for the spring elements are determined by static crushing of various vehicle structural elements. Front, rear and side crush tests were per-

formed in order to obtain the static energy management characteristics of the pertinent structural components of the RSV. The front bumper was subjected to two static crush tests (crush with the bumper attached to the front vehicle structure and compression) and two dynamic tests (pendulum impact and body block impact). To evaluate the rear structure of the vehicle, force-deflection data were developed for the front and rear of the rear rails, the sheet metal and the suspension, and the rear structure was felt to be adequate. Evaluation of the front structure used force-deflection data for the engine mounts, the front rails, the sheet metal, the rear rails and the radiator engine engagement and deficiencies noted in the initial test vehicle were corrected. The side crush tests were performed to determine the longitudinal sidewall strength and the lateral crush properties. The longitudinal sidewall strength was satisfactory and design changes were incorporated to obtain satisfactory sidewall lateral crush properties. The vehicle structure is now felt to meet the minimal requirements for an RSV and vehicles are now being fabricated for a series of full-scale, system integration impact tests.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1976; 132p 1ref
Availability: Reference copy only

HS-802 122

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. RSV TEST NO. 1. RSV VS. HONDA, HEAD-ON FRONTAL IMPACT, 30 MPH EACH VEHICLE

An aligned frontal impact crash test at about 30 mph was performed using the Research Safety Vehicle (RSV) and the Honda CVCC in order to measure the compatibility of these vehicles and to obtain data which could be used to assess the validity of the computer simulation of impacts often used to test vehicle compatibility. In this test the overall crash data suggests that the RSV is not extremely aggressive in relation to the Honda CVCC. Reasonably good passenger compartment integrity was maintained in the Honda CVCC in spite of the mass and structural advantages which exist for the RSV. There is some concern, however, with the responses measured in the front seat occupants of the RSV. The driver dummy rebounded into the B-pillar (which was not equipped to provide impact protection) and the front passenger dummy was impacted by the rear seat dummy. In the latter instance, the rear seat dummy became unrestrained as a result of a failure in the buckle stalk of the three-point system. These two factors accounted for the higher acceleration values measured in these dummies. It appears that correction of the rear seat stalk attachment is straightforward so the problem encountered with the front seat passenger dummy in this test is not considered to be very significant. However, the driver impacting the B-pillar on rebound requires further analysis. This behavior was not uncovered in sled testing (indeed, in those tests, the dummies tended to come together towards the center of the car upon rebound). It is quite possible that items such as bag venting and anchor locations will have to be further considered relative to potential problems associated with occupant rebound.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1976; 95p
Availability: Reference copy only

HS-802 123

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: RSV TEST NO. 2. TYPE OF TEST: PLYMOUTH FURY VS. RSV, 90° SIDE IMPACT, 32 MPH IMPACT SPEED

The test was performed to determine the research safety vehicle (RSV) side structure performance for impact by an intermediate-size vehicle, and the RSV interior protective system, particularly crushable door trim panels. Injury exposure was sought of restrained occupants (using a three-point restraint system) seated in the outboard front seat positions of the striking vehicle and in the front and rear seats of the RSV on the impacted side. Finally compatibility was determined between this collision and results of computer simulations of this collision mode. The test condition was a perpendicular side impact of the RSV by a Plymouth Fury at a speed of 32 mph. Results showed that performance of the RSV side structure was excellent, the exception being the failure of the upper B-pillar/roof attachment, where the maximum intrusion of 11 inches occurred. Considerable reserve crush was left in the interior protection in both door trim panels. The striking vehicle dummies sustained low levels of acceleration. In the RSV, Head Injury Criteria (HIC) numbers for both dummies were well within the specified limit. Excellent load control was achieved for the lower torso for the rear dummy, a system malfunction preventing response data for the front dummy lower torso. Chest accelerations of both dummies exceeded the tolerance limit, indicating that protection provided by the crushable door trim panels is marginal for this test. Good correlation was achieved between the test data and simulation results. Comprehensive vehicle and dummy electronic data are presented, and are processed and filtered according to a given plan and recommended practice.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1976; 87p
Availability: Reference copy only

HS-802 124

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT

Front, rear, and side crush tests of the Simca 1307 were performed to obtain the static energy management characteristics of the various structural components of the base vehicle. Force-deflection data for all major structural components were obtained. These data are used in existing computer simulation programs that simulate various types of vehicle crash conditions. A comprehensive set of static crush data is provided. The data are arranged according to vehicle directions, front, rear, and side. In each instance, a series of tests was performed to provide the desired structural component force-deflection data for the various computer simulation models. A list of observations and photographs that were made during each test is provided. Prior to performing the crush tests, an extensive list of base vehicle measurements was compiled. The basic techniques and crush data are described for several components of the test vehicle as required by the computer model. The components are the engine mounts, the front rail, sheet metal, rear rails and dash, and radiator engine contact.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1975; 61p
Availability: Reference copy only

**RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: A-BASE VEHICLE. TYPE OF TEST:
BARRIER CRASH (45 MPH)**

A Research Safety Vehicle (RSV) (Simca 1307) traveling at 45 plus/minus 1 mph was impacted into a flat barrier. Occupant dummies were located in the left front and right front positions and restrained by the inertial three-point restraint system. The objectives were to determine crash performance at a severe barrier impact speed consistent with RSV requirements and to provide crash data which could be compared with results of the Barrier Crash Simulation (BASHIM) static structural crush analysis. Dummy performance data were to be determined, along with egress characteristics for upper limit impact speed. Finally, the test was to develop data for the Simca comparable to those available for other similar cars, and tests were performed so that direct comparison could eventually be made. Because results from Test C produced data not comparable with those of other vehicles of comparable weight and size, the higher speed (this test) test was performed. A cursory examination of the results of this test when compared to those of other comparable vehicles shows that the performance of the Simca is not notably different. The injury data may be misleading, as the passenger head contacted the hood during this collision. More detailed comparisons will be provided.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1975; 45p
Availability: Reference copy only

HS-802 126

**RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: MOD. B (MODIFIED BASELINE
VEHICLE). TYPE OF TEST: BARRIER CRASHES (NO
DAMAGE - 5 MPH FOLLOWED BY 35 MPH)**

Two flat barrier impact tests were performed on a modified Research Safety Vehicle (RSV) (Simca 1307), one at 5 mph, the other at 35 mph. The RSV front was altered to accept a soft front bumper system to which three sensors were attached. These were to be tested for actuation during the 5 mph impact. Interior alterations included the installation of RSV developed airbelts and load limiters, conventional retractors, a sheet metal knee bolster, and a T slotted breakaway steering linkage, all of which were to be observed after the 35 mph impact. Three sensors, one of which actuated the pressure bottle that inflated the airbelts, were mounted in separate locations to be monitored for performance as a function of location during the 35 mph impact. Two feet of belt webbing were left spooled on the passenger belt retractor and only one inch on the driver side to provide an estimate of the additional slack introduced by the amount of remaining belt spooled around the retractor during the 35 mph impact. Occupant dummies were placed in driver and front passenger positions. In the 5 mph test, no visible vehicle damage was apparent, and the bumper impulse detectors did not fire. Comparison of the bumper force-deflection characteristic with previously performed pendulum-barrier tests was not achieved. In the 35 mph impact test, the results were found satisfactory. All three sensors deployed. The breakaway steering linkage functioned properly. The sheet metal knee bolster performance was acceptable and more crush could have been accommodated. For

occupants, all head and chest injury indicators were reduced, particularly head peak g's. Finally, only a very limited estimate of the additional slack introduced by belt webbing spooled around the retractor was attained. Both vehicle and dummy electronic data are displayed.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1976; 59p
Availability: Reference copy only

HS-802 127

**RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: C (BASE VEHICLE). TYPE OF
TEST: BARRIER CRASH (35 MPH)**

A 35 plus or minus 1 mph flat barrier impact test was performed using a base vehicle Simca 1307 with dummy occupants in the right front and left rear passenger positions restrained by front seat systems marketed on four-door, 1975 Chrysler intermediate automobiles. The test was performed to determine crash performance at an intermediate frontal barrier speed and to provide crash data to compare with results of the Barrier Crash Simulation (BASHIM) static analysis. Further objectives were to determine dummy performance data and egress characteristics (door structural integrity) for intermediate impact speed. After impact all doors could be manually opened and injury criteria were satisfied at all seating positions. When the research safety vehicle (RSV) is constructed this level of performance should not be degraded. Intrusions as large as 6 inches were measured after impact, but these intrusions were not considered significant in relation to measured dummy exposures.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1975; 45p
Availability: Reference copy only

HS-802 128

**RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: F-BASE VEHICLE. TYPE OF TEST:
CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH
VEHICLE, 40 MPH EACH VEHICLE**

A frontal offset impact test was conducted between two base vehicles both moving at 40 mph. Occupant dummies were placed in the left front and right rear seating positions of the first vehicle, and the right front and left rear of the second car. The vehicles were both conventional Simca 1307 base vehicles, and the dummies were restrained by the front seat systems marketed on 4-door 1975 Chrysler intermediate automobiles. Test objectives were to determine crash performance during such an impact, and intercompatibility between front structures of the base vehicles. Further, injury exposure was sought for occupants seated in all seating positions, and egress characteristics of both vehicles were noted after impact. This test is considered important in the research safety vehicle (RSV) development, as models are not available to simulate off-center frontal impact conditions. The most notable aspect of these results is the severe structural collapse of the passenger compartment on each vehicle. This was found due to the relatively low longitudinal door strength of the Simca 1307. This problem will be rectified through incorporation of more substantial longitudinal door strength. Restraint

system data will be used to verify accuracy of the computer model under offset impact conditions. Both vehicle and dummy electronic data are displayed.

Calspan Corp., Buffalo, N.Y. 14221

Contract DOT-HS-5-01214

1975; 79p

Availability: Reference copy only

HS-802 129

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: G--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 90° IMPACT INTO STATIONARY VEHICLE (40 MPH)

A front-to-side 90° impact test was performed using two base vehicles (both Simca 1307) impacting at 40 plus or minus 1 mph. Occupant dummies were placed in the left front seating position of the striking vehicle and in the right front and in the right rear of the struck vehicle. The two passengers were restrained by front seat type systems marketed on four-door 1975 Chrysler intermediate automobiles, the driver dummy by the conventional Simca 1307 system. The impact point occurred where the extreme edge of the striking car hit the front edge of the front door of the struck car. Both vehicles had been damaged in a previous test. Objectives were to determine crash performance during lateral collisions, particularly sidewall resistance properties, and intercompatibility between the front and side structures of the base vehicles. Further objectives were to seek injury exposure of occupants seated on the impact side of the struck vehicle and egress characteristics for the struck and striking vehicles. Results proved extremely promising in relation to the research safety vehicle (RSV) program objectives. Although massive intrusion occurred on the struck vehicle, the dummy exposures were modest. It was shown that sidewall intrusion if properly controlled need not detract from acceptable dummy performance. The B-pillar, although badly deformed, did not separate from either the roof header or lower body sill. Left side doors on both vehicles opened manually after the test. The driver's belt unlatched during impact, but the passenger restraints showed no failures. Both vehicle and dummy electronic data are displayed extensively.

Calspan Corp., Buffalo, N.Y. 14221

Contract DOT-HS-5-01214

1975; 61p

Availability: Reference copy only

HS-802 130

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: H--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 45° IMPACT INTO STATIONARY VEHICLE (40 MPH)

A front-to-side 45° impact test was performed using two base vehicles (both Simca 1307) impacting at 40 plus or minus 1 mph, with occupant dummies in the left front seating position of the striking vehicle and in the left front and left rear of the struck vehicle. The dummies were restrained by front seat type systems marketed on four-door 1975 Chrysler intermediate automobiles. The impact point was located where the extreme edge of the striking car hit the front edge of the front door of the struck car. Test objectives were to determine crash performance during lateral collisions, particularly

sidewall resistance properties, and intercompatibility between the front and side structures of the base vehicles. Data on egress characteristics and injury exposure of occupants seated on the impact side of the struck vehicle were sought. Both vehicles had been damaged in a previous test, so that impact had to occur on the driver side rather than the passenger side, as would be the normal procedure. Large structural deformation occurred on the left front door of the struck vehicle and surprisingly occupant injury data were low. However, because intrusions of such great magnitude are unacceptable, the door structures on the research safety vehicle (RSV) will have to be upgraded. The doors could be opened manually after the test. Both vehicle and dummy electronic data are displayed fully. Photographs and drawings are included.

Calspan Corp., Buffalo, N.Y. 14221

Contract DOT-HS-5-01214

1975; 75p

Availability: Reference copy only

HS-802 131

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: I--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE PERPENDICULAR, 40 MPH EACH CAR

A front-to-side perpendicular impact test was performed using two vehicles (both Simca 1307 base vehicles), the striking vehicle towed at an angle and at a speed of 56.8 mph. The actual impact velocity was 54.14 mph or a simulated impact velocity of 38.30 mph. Occupant dummies were placed in the left front striking vehicle and in the right front and the right rear seating positions of the struck vehicle, and all were restrained by the front seat type systems marketed on four-door 1975 Chrysler intermediate automobiles. The impact point occurred where the extreme edge of the striking car hit the leading edge of the front door on the struck car. Test objectives were to determine crash performance during lateral collisions, particularly sidewall resistance properties, and the intercompatibility between front and side structures of the base vehicles. Further determinations were sought on injury exposure for the occupants seated on the impact side of the struck vehicle and the egress characteristics of the struck and striking vehicles. Results showed substantial vehicle intrusion; however, it is noteworthy that the B-pillar remained attached to the header and lower sill. Occupant injury data, although not within accepted tolerance limits for this test, appear promising. All doors on the striking vehicle could be opened, and doors on side opposite the impact on the struck vehicle were operable. Both vehicle and dummy electronic data are displayed extensively.

Calspan Corp., Buffalo, N.Y. 14221

Contract DOT-HS-5-01214

1975; 66p

Availability: Reference copy only

HS-802 132

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: J--BASE VEHICLE TYPE OF TEST: FRONT-TO-SIDE 45°, 40 MPH EACH CAR

A front-to-side 45° impact test was performed on two base vehicles (both Simca 1307) impacting at 40 mph. Because of the angle, the actual impact velocity of the towed or striking

vehicle was 71.49 mph to approximate the impact velocity assumed for each car. Occupant dummies were placed in the left front seating position of the striking vehicle and in the right front and the right rear of the striking vehicle. They were restrained in the struck vehicle by front seat type systems marketed on four-door 1975 Chrysler intermediate automobiles. The impact point occurred where the extreme edge of the striking car hit the leading edge of the front door on the struck car. Objectives were to determine the crash performance during lateral collisions, particularly sidewall resistance properties, and the intercompatibility between front and side structures of the base vehicles. Further objectives were to determine the injury exposure for occupants seated on the impact side of the struck vehicle and the egress characteristics of the struck and striking vehicles. This test was the most severe of the four side impact tests conducted with the base vehicle, with respect to both struck vehicle collapse (intrusion) and occupant exposure. The most notable result was the tearing away of the B-pillar from the lower sill. This caused massive side wall collapse, door opening on street side, and direct impact loading on the rear seat dummy. A redesigned B-pillar planned for the research safety vehicle (RSV) will improve the performance. All doors in the striking vehicle were operable and the left side doors were operable in the struck vehicle. The restraint systems showed no failures. Both vehicle and dummy electronic data are extensively displayed.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1975; 82p
Availability: Reference copy only

HS-802 133

**RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: L (BASE VEHICLE). TYPE OF
TEST: REAR IMPACT INTO STATIONARY VEHICLE
AT 50 MPH**

A test was conducted involving a rear impact into a stationary (base) vehicle. The stationary vehicle was impacted at 50 mph and was previously used in a frontal impact test (Test C). This vehicle was repaired only to the extent necessary to regain the original 102.5 inch wheelbase and proper front-to-rear bumper alignment. Otherwise the vehicle (1307 Simca) was severely damaged, though this damage was not considered pertinent to test results. A Volvo 244 DL seat was installed in the front seat position of the struck vehicle and was attached directly to the floor. The Volvo seat was chosen because it probably represents above average structural strength in relation to current seat design practice. Occupant dummies were placed in the left front seat of the striking vehicle (also a Simca 1307) and in the right front and left rear seats of the struck vehicle. Objectives were to determine the rear structural integrity of the base vehicle, the likelihood of override/underide between the base vehicle front and rear structures, and the integrity provided by both front and rear seat backs. No failures were observed in the glazing of the striking vehicle. The rear window of the struck vehicle came out on impact and the left rear window shattered. All doors were operable except the left rear door of the struck vehicle. No failures in restraint operation were noticed. No failure of seat anchorages were noticed in the striking vehicle, but the Volvo seat bent all the way back and rested on the rear seat in the struck vehicle. The rear structure of the base vehicle performed adequately and it is felt that any structural changes in the RSV should be minor.

The fuel filler tube ruptured during the collision resulting in fuel loss. It is felt that rerouting will remove the tube from the structural collapse area of the vehicle. Results indicate that front seat back constitutes a problem area for this type of collision and it is apparent that some redesign will be necessary. There appeared to be a reasonably good match between front and rear structures of the two vehicles as vehicle override/underide was evident. Both vehicle and dummy electronic data are extensively displayed.

Calspan Corp., Buffalo, N.Y. 14221
Contract DOT-HS-5-01214
1975; 62p
Availability: Reference copy only

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: A--BASE VEHICLE. TYPE OF TEST: BARRIER CRASH (45 MPH)

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: C (BASE VEHICLE). TYPE OF TEST: BARRIER CRASH (35 MPH)

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: F--BASE VEHICLE. TYPE OF TEST: CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH VEHICLE, 40 MPH EACH VEHICLE

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: G--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 90° IMPACT INTO STATIONARY VEHICLE (40 MPH)

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: MOD. B (MODIFIED BASELINE VEHI-
CLE). TYPE OF TEST: BARRIER CRASHES (NO
DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: I--BASE VEHICLE. TYPE OF TEST:
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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
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REPORT. TEST: F-BASE VEHICLE. TYPE OF TEST:
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IDENTIFICATION OF MATHEMATICAL MODELS FROM IMPACT DATA: APPLICATION TO THORACIC IMPACT

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THE EFFECTIVENESS OF MATHEMATICAL MODELS AS A HUMAN ANALOG

HS-019 986

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A MODIFICATION OF COMBUSTION SYSTEMS FOR LOW EXHAUST EMISSION AND ITS EFFECTS ON DURABILITY OF PRECHAMBER DIESEL ENGINE

HS-019 744

MODIFIED

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: MOD. B (MODIFIED BASELINE VEHICLE). TYPE OF TEST: BARRIER CRASHES (NO DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

HS-802 126

MONITOR

AN ASSESSMENT OF THE EFFECTIVENESS OF THE FOLLOWING-TOO-CLOSELY MONITOR

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CARBON MONOXIDE: A DANGER TO THE DRIVER?

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HIGHWAY ACCIDENT REPORT. COLLISION OF WINNEBAGO MOTOR HOME WITH BRIDGE COLUMN, NEAR MONROE, MICHIGAN, JULY 1, 1975

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A CRITICAL REVIEW OF FEDERAL MOTOR VEHICLE SAFETY STANDARD 105

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INTERIOR SAFETY OF AUTOMOBILES. ROAD TRAFFIC ACCIDENTS AND THEIR CONSEQUENCES. A STUDY BY GERMAN MOTOR TRAFFIC INSURERS ON 28,936 CAR CRASHES WITH PASSENGER INJURY

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MOTOR CARRIER ACCIDENT INVESTIGATION. ADAMS PRODUCE COMPANY ACCIDENT-FEBRUARY 16, 1976-LAKE PLACID, FLORIDA

HS-019 747

MOTOR CARRIER ACCIDENT INVESTIGATION. TRI-STATE MOTOR TRANSIT COMPANY, INC. ACCIDENT - FEBRUARY 13, 1976 - GILA BEND, ARIZONA

HS-020 001

MOTOR VEHICLE SAFETY SEMINAR. KEY ISSUES IN HEAVY TRUCK SAFETY. TRANSCRIPT OF PROCEEDINGS, JULY 12, 1976

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MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY. POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

HS-802 116

MOTOR VEHICLE SAFETY SEMINAR. RESTRAINT SYSTEM EFFECTIVENESS. TRANSCRIPT OF PROCEEDINGS, JULY 13, 1976

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NATIONAL MOTOR VEHICLE SAFETY ADVISORY COUNCIL MEETING, JULY 15, 1976. STENOGRAPHIC TRANSCRIPT OF HEARINGS

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SYSTEMS AND HARDWARE EFFECTS OF FMVSS OF FEDERAL MOTOR VEHICLE SAFETY STANDARD 105-75

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TIME-SHARED MULTIPLEXING SYSTEM APPLIED TO MOTOR VEHICLES

HS-019 702

1974 ACCIDENTS OF MOTOR CARRIERS OF PROPERTY

HS-020 011

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A STUDY OF IDAHO MOTORCYCLISTS INJURED IN 1974 ACCIDENTS

HS-019 705

MOTORIST

MOTORIST AID SYSTEMS STUDY. FINAL POLICY REPORT

HS-019 695

MOTORIST AID SYSTEMS STUDY. STATE OF THE ART REPORT. FINAL REPORT

HS-020 017

MULTIDISCIPLINARY

MULTIDISCIPLINARY ACCIDENT INVESTIGATION. VOL. 1. FINAL REPORT

HS-802 033

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THE DESIGN AND PRESCRIPTION OF MULTIFOVAL LENSES FOR CIVIL PILOTS

HS-019 772

MULTIPLEXING

TIME-SHARED MULTIPLEXING SYSTEM APPLIED TO MOTOR VEHICLES

HS-019 702

MULTIPURPOSE

HIGHWAY ACCIDENT REPORT. IMMIGRATION AND NATURALIZATION SERVICE MULTIPURPOSE VEHICLE/T.R. PRODUCE COMPANY TRUCK COLLISION, NEAR EL CENTRO, CALIFORNIA, MARCH 8, 1974

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MYSTERY

UNBUCKLING THE SEAT BELT MYSTERY

HS-019 689

NATIONAL

NATIONAL MOTOR VEHICLE SAFETY ADVISORY COUNCIL MEETING, JULY 15, 1976. STENOGRAPHIC TRANSCRIPT OF HEARINGS

HS-802 117

NATURALIZATION

HIGHWAY ACCIDENT REPORT. IMMIGRATION AND
NATURALIZATION SERVICE MULTIPURPOSE VEHIC-
LE/T.R. PRODUCE COMPANY TRUCK COLLISION,
NEAR EL CENTRO, CALIFORNIA, MARCH 8, 1974

HS-019 681

NECK

THREE DIMENSIONAL MODEL OF THE HUMAN
HEAD AND NECK FOR AUTOMOBILE CRASHES

HS-019 981

NEUROMUSCULAR

NEUROMUSCULAR CERVICAL SPINE MODEL FOR
WHIPLASH

HS-019 982

NOISE

THE NOISE AND TRACTION CHARACTERISTICS OF
BIAS PLY TRUCK TIRES. VOL. 1 NOISE AND DRY
TRACTION FINDINGS

HS-019 693

THE NOISE AND TRACTION CHARACTERISTICS OF
BIAS-PLY TRUCK TIRES. VOL. 2. WET TRACTION
FINDINGS

HS-019 694

NYRICS

VALIDITY TEST OF NEW YORK STATE INJURY COD-
ING SCHEME (NYRICS)

HS-019 365

OBLIQUE

A STUDY TO DETERMINE THE CAUSES OF AC-
CIDENTS: AN IN-DEPTH CASE REPORT CASE NO.
TAC-SP-75-6, SCHOOL BUS/GARBAGE TRUCK--
ACUTE OBLIQUE. FINAL REPORT

HS-802 056

OCCURRING

AN ANALYSIS OF THE JUDICIAL OUTCOME AND
PROCESS OF 2443 OPERATING UNDER THE IN-
FLUENCE OF ALCOHOL ARRESTS OCCURRING IN
CUMBERLAND/YORK (MAINE) COUNTIES IN 1972

HS-019 721

OFFICIALS

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PRO-
GRAM. LOCAL OFFICIALS

HS-020 032

OFFSET

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: F--BASE VEHICLE. TYPE OF TEST:
CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH
VEHICLE, 40 MPH EACH VEHICLE

HS-802 128

OIL

A SYNTHESIZED ENGINE OIL PROVIDING FUEL
ECONOMY BENEFITS

HS-019 664

DIESEL VEHICLES?--CRUDE OIL SCENE

HS-019 741

HIGHWAY ACCIDENT REPORT. HOPPY'S OIL SER-
VICE, INC., TRUCK OVERTURN AND FIRE, STATE
ROUTE 128, BRAINTREE, MASSACHUSETTS, OC-
TOBER 18, 1973

HS-019 684

OPERATING

AN ANALYSIS OF THE JUDICIAL OUTCOME AND
PROCESS OF 2443 OPERATING UNDER THE IN-
FLUENCE OF ALCOHOL ARRESTS OCCURRING IN
CUMBERLAND/YORK (MAINE) COUNTIES IN 1972

HS-019 721

OPERATION

EMERGENCY CONTROL OF VEHICLE PLATOONS;
CONTROL OF FOLLOWING-LAW VEHICLES.
SYSTEM OPERATION AND PLATOON LEADER CON-
TROL

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OPTIMIZATION

THE OPTIMIZATION OF BODY DETAILS--A METHOD
FOR REDUCING THE AERODYNAMIC DRAG OF
ROAD VEHICLES

HS-019 727

OPTIMIZING

OPTIMIZING ENGINE AND CAR DESIGN FOR FUEL
ECONOMY AND EMISSIONS

HS-019 665

OPTOMETRIC

COLOR VISION TESTING IN OPTOMETRIC PRACTICE

HS-019 752

OREGON

HIGHWAY ACCIDENT REPORT. SISKIYOU UNION
HIGH SCHOOL DISTRICT SCHOOLBUS/AUTOMOBILE
COLLISION AND ROLLOVER, I-5, ASHLAND
OREGON, MAY 9, 1975

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POLICY-ORIENTED MODELING OF NEW AUTOMO-
BILE SALES AND FUEL CONSUMPTION

HS-020 003

OUTCOME

AN ANALYSIS OF THE JUDICIAL OUTCOME AND
PROCESS OF 2443 OPERATING UNDER THE IN-
FLUENCE OF ALCOHOL ARRESTS OCCURRING IN
CUMBERLAND/YORK (MAINE) COUNTIES IN 1972

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OUTSIDE

TAKING A SOUND APPROACH TO TRANSPORTA-
TION SAFETY. A SUGGESTION FOR REDUCING AC-
CIDENTS OUTSIDE THE SCHOOL BUS

HS-019 709

OVERTURN

HIGHWAY ACCIDENT REPORT. HOPPY'S OIL SER-
VICE, INC., TRUCK OVERTURN AND FIRE, STATE
ROUTE 128, BRAINTREE, MASSACHUSETTS, OC-
TOBER 18, 1973

HS-019 684

HIGHWAY ACCIDENT REPORT. SURTIGAS, S.A.,
TANK-SEMITRAILER OVERTURN, EXPLOSION, AND
FIRE, NEAR EAGLE PASS, TEXAS, APRIL 29, 1975

HS-019 673

PACKAGE

AN EXPERIMENTAL STUDY OF PACKAGE
CUSHIONING FOR THE HUMAN HEAD

HS-019 991

April 30, 1977

PARAMETERIC

A PARAMETERIC INVESTIGATION OF THE VALIDITY OF 1/25 SCALE AUTOMOBILE AERODYNAMIC TESTING

HS-019 731

PART

ENGINEERING KNOW-HOW IN ENGINE DESIGN.
PART 24. ECONOMY IN ENGINE PERFORMANCE

HS-019 662

PASS

HIGHWAY ACCIDENT REPORT. SURTIGAS, S.A.,
TANK-SEMITRAILER OVERTURN, EXPLOSION, AND
FIRE, NEAR EAGLE PASS, TEXAS, APRIL 29, 1975

HS-019 673

PASSENGER

INTERIOR SAFETY OF AUTOMOBILES. ROAD TRAFFIC
ACCIDENTS AND THEIR CONSEQUENCES. A
STUDY BY GERMAN MOTOR TRAFFIC INSURERS ON
28,936 CAR CRASHES WITH PASSENGER INJURY

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RAILROAD/HIGHWAY ACCIDENT REPORT. COLLISION
OF A CROWN-TRYGG CONSTRUCTION COMPANY
TRUCK WITH AN AMTRAK PASSENGER
TRAIN, ELWOOD, ILLINOIS, NOVEMBER 19, 1975

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TRAFFIC VIOLATION FREQUENCIES OF STATE
HOSPITAL PSYCHIATRIC PATIENTS

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AN ANALYSIS OF ASAP ALCOHOL SAFETY ACTION
PROJECT PATROL ACTIVITY FROM JANUARY
1, 1972 TO DECEMBER 31, 1974

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PAVEMENT

RELATING PAVEMENT ROUGHNESS TO VEHICLE
BEHAVIOR. FINAL REPORT

HS-019 995

TENTATIVE PAVEMENT AND GEOMETRIC DESIGN
CRITERIA FOR MINIMIZING HYDROPLANING.
PHASE 1. FINAL REPORT

HS-019 997

PAYOFFS

HUMAN ENGINEERING SPECIFICATIONS AND
STANDARDS: PAYOFFS AND PITFALLS

HS-019 732

PELTZMAN

A CRITICAL ANALYSIS OF PELTZMAN'S "THE EFFECTS
OF AUTOMOBILE SAFETY REGULATION"

HS-019 699

PENNSYLVANIA

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM.
COUNSELING AND REHABILITATION

HS-020 029

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM.
ENFORCEMENT

HS-020 030

PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM.
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PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM.
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PENNSYLVANIA ALCOHOL HIGHWAY SAFETY PROGRAM.
CURRICULUM AND INSTRUCTOR'S GUIDE

HS-020 033

PERCEPTION

ERRORS IN SPACE PERCEPTION DUE TO ACCOMMODATIVE
RETINAL ADVANCE

HS-019 908

PERFORMANCE

AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES
TO DETERMINE TOTAL PROJECT IMPACT

HS-019 717

ENGINEERING KNOW-HOW IN ENGINE DESIGN.
PART 24. ECONOMY IN ENGINE PERFORMANCE

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MAINE ASAP ALCOHOL SAFETY ACTION PROJECT.
YORK AND CUMBERLAND COUNTIES. KEY ANALYTIC
STUDY. AN ANALYSIS OF ULTIMATE PERFORMANCE
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STRATEGY FOR SAVING GASOLINE BY SUBSTITUTING
LOW PERFORMANCE ELECTRIC VEHICLES

HS-020 010

TENTATIVE ROAD ROUGHNESS CRITERIA BASED
UPON VEHICLE PERFORMANCE. FINAL REPORT

HS-019 996

VISUAL PERFORMANCE THROUGH A SAMPLE
WINDSHIELD SEGMENT OF THE B-1 AIRCRAFT

HS-019 933

PERIPHERAL

PERIPHERAL VISUAL RESPONSE TIME AND
RETINAL LUMINANCE-AREA RELATIONS

HS-019 859

PERPENDICULAR

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: I-BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE PERPENDICULAR, 40 MPH EACH
CAR

HS-802 131

PERTH

BEFORE AND AFTER COMPARISONS OF THE INTRODUCTION
OF SUNDAY SESSIONS IN THE PERTH METROPOLITAN
AREA FROM THE VIEWPOINT OF TRAFFIC SAFETY

HS-019 710

PHASES

SECOND GENERATION EYELLIPSE PROJECT.
PHASES 1 AND 2. COMPARISONS OF DYNAMIC EYE
POSITIONS IN A LABORATORY BUCK. STATIC VEHICLE
AND ON-THE-ROAD VEHICLE. FINAL REPORT

HS-019 667

PHOTOELASTIC

PHOTOELASTIC STAMPING ANALYSIS ADDS VISION
TO NEW AUTOMOTIVE MATERIAL DEVELOPMENTS

HS-019 736

PICKUP

HIGHWAY ACCIDENT REPORT. FRANCISCO FLORES TRUCK/PICKUP TRUCK WITH CAMPER AND TRAILER COLLISION, U.S. ROUTE 395, BISHOP, CALIFORNIA, JUNE 29, 1974

HS-019 682

PILOTS

THE DESIGN AND PRESCRIPTION OF MULTIFOCAL LENSES FOR CIVIL PILOTS

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PITFALLS

HUMAN ENGINEERING SPECIFICATIONS AND STANDARDS: PAYOFFS AND PITFALLS

HS-019 732

PLACID

MOTOR CARRIER ACCIDENT INVESTIGATION. ADAMS PRODUCE COMPANY ACCIDENT--FEBRUARY 16, 1976--LAKE PLACID, FLORIDA

HS-019 747

PLAN

LORAN-C FEASIBILITY DEMONSTRATION PLAN. FINAL REPORT

HS-802 057

RESEARCH PLAN FOR ACHIEVING REDUCED AUTOMOTIVE ENERGY CONSUMPTION

HS-020 000

PLASTIC

ANALYSIS OF ELASTIC-PLASTIC IMPACT INVOLVING SEVERE DISTORTIONS

HS-019 992

PLATOON

EMERGENCY CONTROL OF VEHICLE PLATOONS: CONTROL OF FOLLOWING-LAW VEHICLES. SYSTEM OPERATION AND PLATOON LEADER CONTROL

HS-019 993

PLATOONS

EMERGENCY CONTROL OF VEHICLE PLATOONS: CONTROL OF FOLLOWING-LAW VEHICLES. SYSTEM OPERATION AND PLATOON LEADER CONTROL

HS-019 993

PLY

THE NOISE AND TRACTION CHARACTERISTICS OF BIAS PLY TRUCK TIRES. VOL. 1 NOISE AND DRY TRACTION FINDINGS

HS-019 693

THE NOISE AND TRACTION CHARACTERISTICS OF BIAS-PLY TRUCK TIRES. VOL. 2. WET TRACTION FINDINGS

HS-019 694

PLYMOUTH

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: RSV TEST NO. 2. TYPE OF TEST: PLYMOUTH FURY VS. RSV, 90° SIDE IMPACT. 32 MPH IMPACT SPEED

HS-802 123

POLICY

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY, POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

HS-802 116

MOTORIST AID SYSTEMS STUDY. FINAL POLICY REPORT

HS-019 695

POLICY-ORIENTED MODELING OF NEW AUTOMOBILE SALES AND FUEL CONSUMPTION

HS-020 003

POLITICS

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY, POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

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POPULATION

ISSUES CONCERNING MEASUREMENT OF THE POPULATION AT RISK IN CRASHES

HS-019 038

POPULATIONS

STATISTICAL ASPECTS OF INJURY SEVERITY. PT. 1: COMPARISON OF TWO POPULATIONS WHEN THERE ARE SEVERAL GRADES OF INJURY

HS-019 989

STATISTICAL ASPECTS OF INJURY SEVERITY. PT. 2: THE CASE OF SEVERAL POPULATIONS BUT ONLY THREE GRADES OF INJURY

HS-019 990

PORTS

DESIGNING EXHAUST PORTS FOR LOW HEAT TRANSFER

HS-020 036

POSITIONS

SECOND GENERATION EYELLIPSE PROJECT. PHASES 1 AND 2. COMPARISONS OF DYNAMIC EYE POSITIONS IN A LABORATORY BUCK, STATIC VEHICLE AND ON-THE-ROAD VEHICLE. FINAL REPORT

HS-019 667

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COLOR VISION TESTING IN OPTOMETRIC PRACTICE

HS-019 752

PRECHAMBER

A MODIFICATION OF COMBUSTION SYSTEMS FOR LOW EXHAUST EMISSION AND ITS EFFECTS ON DURABILITY OF PRECHAMBER DIESEL ENGINE

HS-019 744

PRECHAMBER DESIGN IMPROVES LEAN DRIVEABILITY

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A MATHEMATICAL MODEL TO PREDICT SKULL FRACTURE UNDER IMPACT LOADS

HS-019 980

PREPARATION

INLET VALVE THROTTLING AND THE EFFECTS OF MIXTURE PREPARATION AND TURBULENCE ON

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THE EXHAUST GAS EMISSIONS OF A SPARK IGNITION ENGINE

HS-020 025

PRESCRIPTION

THE DESIGN AND PRESCRIPTION OF MULTIFOCAL LENSES FOR CIVIL PILOTS

HS-019 772

PRESIDENT

THE EFFECTIVENESS OF MILES-PER-GALLON METERS AS A MEANS TO CONSERVE GASOLINE IN AUTOMOBILES. REPORT TO THE CONGRESS AND THE PRESIDENT FROM THE SECRETARY OF TRANSPORTATION

HS-020 016

PROBLEM

A CASE OF FUNCTIONAL HYPOGLYCAEMIA OHYPOGLYCAMIA0-A MEDICO-LEGAL PROBLEM

HS-019 672

PROBLEM IDENTIFICATION MANUAL FOR TRAFFIC SAFETY PROGRAMS. VOL. 1

HS-802 084

PROBLEM IDENTIFICATION MANUAL FOR TRAFFIC SAFETY PROGRAMS. VOL. 2. MODEL REPORTS

HS-802 085

PROCEEDINGS

MOTOR VEHICLE SAFETY SEMINAR. KEY ISSUES IN HEAVY TRUCK SAFETY. TRANSCRIPT OF PROCEEDINGS, JULY 12, 1976

HS-802 114

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY, POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

HS-802 116

MOTOR VEHICLE SAFETY SEMINAR. RESTRAINT SYSTEM EFFECTIVENESS. TRANSCRIPT OF PROCEEDINGS, JULY 13, 1976

HS-802 115

PROCESS

AN ANALYSIS OF THE JUDICIAL OUTCOME AND PROCESS OF 2443 OPERATING UNDER THE INFLUENCE OF ALCOHOL ARRESTS OCCURRING IN CUMBERLAND/YORK (MAINE) COUNTIES IN 1972

HS-019 721

PRODUCE

HIGHWAY ACCIDENT REPORT. IMMIGRATION AND NATURALIZATION SERVICE MULTIPURPOSE VEHICLE/T.R. PRODUCE COMPANY TRUCK COLLISION, NEAR EL CENTRO, CALIFORNIA, MARCH 8, 1974

HS-019 681

MOTOR CARRIER ACCIDENT INVESTIGATION. ADAMS PRODUCE COMPANY ACCIDENT-FEBRUARY 16, 1976-LAKE PLACID, FLORIDA

HS-019 747

PROJECT

A STUDY OF THE IDENTIFICATION AND REFERRAL ACTIVITY OF THE CUMBERLAND/YORK (MAINE) ALCOHOL SAFETY ACTION PROJECT. 1972

HS-019 720

ALCOHOL SAFETY ACTION PROJECT BIBLIOGRAPHY

HS-020 015

AN ANALYSIS OF ASAP ALCOHOL SAFETY ACTION PROJECT PATROL ACTIVITY FROM JANUARY 1, 1972 TO DECEMBER 31, 1974

HS-019 725

AN ANALYSIS OF CUMBERLAND/YORK (MAINE) ALCOHOL SAFETY ACTION PROJECT ENFORCEMENT ACTIVITY FOR 1972

HS-019 716

AN ANALYSIS OF THE IMPACT OF ASAP ALCOHOL SAFETY ACTION PROJECT ON THE TRAFFIC SAFETY SYSTEM

HS-019 726

AN ANALYSIS OF THE IMPACT OF ASAP (ALCOHOL SAFETY ACTION PROJECT) ON THE TRAFFIC SAFETY SYSTEM

HS-019 718

AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES TO DETERMINE TOTAL PROJECT IMPACT

HS-019 717

MAINE ASAP ALCOHOL SAFETY ACTION PROJECT. BAC OBLOOD ALCOHOL CONCENTRATION DATA FOR DRIVERS FATALLY INJURED. KEY ANALYTIC STUDY

HS-019 715

MAINE ASAP ALCOHOL SAFETY ACTION PROJECT. YORK AND CUMBERLAND COUNTIES. KEY ANALYTIC STUDY. AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES

HS-019 713

MAINE ASAP ALCOHOL SAFETY ACTION PROJECT. YORK AND CUMBERLAND COUNTIES. KEY ANALYTIC STUDY. AN ANALYSIS OF ULTIMATE MEASURES. UPDATED

HS-019 714

SECOND GENERATION EYELLIPSE PROJECT. PHASES 1 AND 2. COMPARISONS OF DYNAMIC EYE POSITIONS IN A LABORATORY BUCK, STATIC VEHICLE AND ON-THE-ROAD VEHICLE. FINAL REPORT

HS-019 667

THE RESULTS OF THE CUMBERLAND/YORK (MAINE) ASAP (ALCOHOL SAFETY ACTION PROJECT) REHABILITATION COUNTERMEASURES IN TERMS OF ARREST OF 1142 DRINKER DRIVERS CONTACTED BY REHABILITATION FROM JANUARY 1, 1972 TO DECEMBER 31, 1974

HS-019 711

THE RESULTS OF THE CUMBERLAND/YORK (MAINE) ASAP (ALCOHOL SAFETY ACTION PROJECT) REHABILITATION COUNTERMEASURES IN TERMS OF ARREST AND CRASH RECIDIVISM OF 833 DRINKER DRIVERS CONTACTED AND/OR TREATED IN 1973

HS-019 712

PROPERTY

1974 ACCIDENTS OF MOTOR CARRIERS OF PROPERTY

HS-020 011

PROTECTION

TRADEOFFS ASSOCIATED WITH POSSIBLE AUTO EMISSION STANDARDS. A REPORT TO THE ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

HS-020 014

PROVIDING

A SYNTHESIZED ENGINE OIL PROVIDING FUEL ECONOMY BENEFITS

HS-019 664

PSYCHIATRIC

TRAFFIC VIOLATION FREQUENCIES OF STATE HOSPITAL PSYCHIATRIC PATIENTS

HS-019 698

PSYCHOMOTOR

EFFECT OF TWO WEEKS' TREATMENT WITH CHLORDIAZEPOXIDE OR FLUPENTHIXOLE, ALONE OR IN COMBINATION WITH ALCOHOL, ON PSYCHOMOTOR SKILLS RELATED TO DRIVING

HS-019 704

PUBLIC

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY, POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

HS-082 116

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RACIAL DIFFERENCES IN COLOR VISION: DO THEY EXIST?

HS-019 826

RADIO

APPLICATION OF COMMERCIAL RADIO TO FREEWAY COMMUNICATIONS - A STUDY OF DRIVER ATTITUDES

HS-019 994

RAILROAD

RAILROAD/HIGHWAY ACCIDENT REPORT. COLLISION OF A CROWN-TRYGG CONSTRUCTION COMPANY TRUCK WITH AN AMTRAK PASSENGER TRAIN, ELWOOD, ILLINOIS, NOVEMBER 19, 1975

HS-019 679

RAIN

WAXED WINDSHIELDS ARE HAZARDOUS IN THE RAIN

HS-019 763

RATE

HIGH STRAIN RATE BEHAVIOR OF SOME HOT AND COLD ROLLED LOW CARBON STEELS

HS-019 740

RATIONAL

A RATIONAL APPROACH TO LICENSE DRIVERS USING BIOPTIC TELESCOPES

HS-019 920

REAR

DYNAMIC BEHAVIOUR OF A ROAD VEHICLE WITH REAR WHEEL ADAPTIVE BRAKING CONTROL

HS-020 023

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: L (BASE VEHICLE). TYPE OF TEST: REAR IMPACT INTO STATIONARY VEHICLE AT 50 MPH

HS-082 133

REBATES

ANALYSIS OF FUEL ECONOMY EXCISE TAXES AND REBATES

HS-020 009

RECIDIVISM

THE RESULTS OF THE CUMBERLAND/YORK (MAINE) ASAP (ALCOHOL SAFETY ACTION PROJECT) REHABILITATION COUNTERMEASURES IN TERMS OF ARREST AND CRASH RECIDIVISM OF 833 DRINKER DRIVERS CONTACTED AND/OR TREATED IN 1973

HS-019 712

RECONSTRUCTION

STABILITY CONSIDERATIONS IN THE MATHEMATICAL RECONSTRUCTION OF TRAFFIC ACCIDENTS

HS-019 987

REDUCED

FUEL VAPOURIZATION. ECONOMY WITH REDUCED EXHAUST EMISSION

HS-020 024

RESEARCH PLAN FOR ACHIEVING REDUCED AUTOMOTIVE ENERGY CONSUMPTION

HS-020 000

REDUCING

REDUCING FUEL CONSUMPTION BY MEANS OF AERODYNAMIC "ADD-ON" DEVICES

HS-019 729

STRATEGIES FOR REDUCING GASOLINE CONSUMPTION THROUGH IMPROVED MOTOR VEHICLE EFFICIENCY. A REPORT OF AN INFORMAL TRANSPORTATION RESEARCH BOARD WORKSHOP

HS-020 002

TAKING A SOUND APPROACH TO TRANSPORTATION SAFETY. A SUGGESTION FOR REDUCING ACCIDENTS OUTSIDE THE SCHOOL BUS

HS-019 709

THE OPTIMIZATION OF BODY DETAILS--A METHOD FOR REDUCING THE AERODYNAMIC DRAG OF ROAD VEHICLES

HS-019 727

REDUCTION

HIGH-STRENGTH STEEL FOR COST EFFECTIVE WEIGHT REDUCTION

HS-019 738

REFERRAL

A STUDY OF THE IDENTIFICATION AND REFERRAL ACTIVITY OF THE CUMBERLAND/YORK (MAINE) ALCOHOL SAFETY ACTION PROJECT, 1972

HS-019 720

AN ANALYSIS OF DRINKER DIAGNOSIS AND REFERRAL

HS-019 719

AN ANALYSIS OF DRINKER DIAGNOSIS AND REFERRAL

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: A--BASE VEHICLE. TYPE OF TEST: BARRIER CRASH (45 MPH)

HS-802 125

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: MOD. B (MODIFIED BASELINE VEHICLE). TYPE OF TEST: BARRIER CRASHES (NO DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

HS-802 126

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: C (BASE VEHICLE). TYPE OF TEST: BARRIER CRASH (35 MPH)

HS-802 127

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: F--BASE VEHICLE. TYPE OF TEST: CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH VEHICLE, 40 MPH EACH VEHICLE

HS-802 128

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: G--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 90° IMPACT INTO STATIONARY VEHICLE (40 MPH)

HS-802 129

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: H--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 45° IMPACT INTO STATIONARY VEHICLE (40 MPH)

HS-802 130

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: I--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE PERPENDICULAR, 40 MPH EACH CAR

HS-802 131

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: J--BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 45°, 40 MPH EACH CAR

HS-802 132

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: L (BASE VEHICLE). TYPE OF TEST: REAR IMPACT INTO STATIONARY VEHICLE AT 50 MPH

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HIGHWAY ACCIDENT REPORT. HOPPY'S OIL SERVICE, INC., TRUCK OVERTURN AND FIRE, STATE ROUTE 128, BRAINTREE, MASSACHUSETTS, OCTOBER 18, 1973

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST

REPORT. TEST: RSV TEST NO. 2. TYPE OF TEST:
PLYMOUTH FURY VS. RSV, 90° SIDE IMPACT, 32
MPH IMPACT SPEED

HS-802 123

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: A--BASE VEHICLE. TYPE OF TEST:
BARRIER CRASH (45 MPH)

HS-802 125

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: MOD. B (MODIFIED BASELINE VEHIC-
LE). TYPE OF TEST: BARRIER CRASHES (NO
DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

HS-802 126

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: C (BASE VEHICLE). TYPE OF TEST:
BARRIER CRASH (35 MPH)

HS-802 127

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: F--BASE VEHICLE. TYPE OF TEST:
CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH
VEHICLE, 40 MPH EACH VEHICLE

HS-802 128

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: G--BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE 90° IMPACT INTO STATIONARY
VEHICLE (40 MPH)

HS-802 129

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: H--BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE 45° IMPACT INTO STATIONARY
VEHICLE (40 MPH)

HS-802 130

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: I--BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE PERPENDICULAR, 40 MPH EACH
CAR

HS-802 131

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: J--BASE VEHICLE TYPE OF TEST:
FRONT-TO-SIDE 45°, 40 MPH EACH CAR

HS-802 132

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: L (BASE VEHICLE). TYPE OF TEST:
REAR IMPACT INTO STATIONARY VEHICLE AT 50
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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: G-BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 90° IMPACT INTO STATIONARY VEHICLE (40 MPH)

HS-802 11

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: H-BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 45° IMPACT INTO STATIONARY VEHICLE (40 MPH)

HS-802 11

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STRATEGY FOR SAVING GASOLINE BY SUBSTITUTING LOW PERFORMANCE ELECTRIC VEHICLES

HS-020 010

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HS-019 762

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HS-019 673

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THE MAINE ROADSIDE SURVEY. 1972 FINAL REPORT

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HS-802 056

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TAKING A SOUND APPROACH TO TRANSPORTATION SAFETY. A SUGGESTION FOR REDUCING ACCIDENTS OUTSIDE THE SCHOOL BUS

HS-019 709

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HIGHWAY ACCIDENT REPORT. SURTIGAS, S.A., TANK-SEMITRAILER OVERTURN, EXPLOSION, AND FIRE, NEAR EAGLE PASS, TEXAS, APRIL 29, 1975

HS-019 673

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HS-019 668

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DRIVING WITH A BIOPTIC TELESCOPE: AN INTERDISCIPLINARY APPROACH

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PHASE 1. FINAL REPORT

HS-019 997

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HS-019 996

TERMS

THE RESULTS OF THE CUMBERLAND/YORK
(MAINE) ASAP (ALCOHOL SAFETY ACTION PRO-
JECT) REHABILITATION COUNTERMEASURES IN
TERMS OF ARREST OF 1142 DRINKER DRIVERS CON-
TACTED BY REHABILITATION FROM JANUARY 1,
1972 TO DECEMBER 31, 1974

HS-019 711

THE RESULTS OF THE CUMBERLAND/YORK
(MAINE) ASAP (ALCOHOL SAFETY ACTION PRO-
JECT) REHABILITATION COUNTERMEASURES IN
TERMS OF ARREST AND CRASH RECIDIVISM OF 833
DRINKER DRIVERS CONTACTED AND/OR TREATED
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HS-019 712

TEST

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. RSV TEST NO. 1. RSV VS. HONDA, HEAD-
ON FRONTAL IMPACT, 30 MPH EACH VEHICLE

HS-802 122

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: RSV TEST NO. 2. TYPE OF TEST:
PLYMOUTH FURY VS. RSV, 90° SIDE IMPACT, 32
MPH IMPACT SPEED

HS-802 123

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: A-BASE VEHICLE. TYPE OF TEST:
BARRIER CRASH (45 MPH)

HS-802 125

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: MOD. B (MODIFIED BASELINE VEHI-
CLE). TYPE OF TEST: BARRIER CRASHES (NO
DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

HS-802 126

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: C (BASE VEHICLE). TYPE OF TEST:
BARRIER CRASH (35 MPH)

HS-802 127

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: F-BASE VEHICLE. TYPE OF TEST:
CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH
VEHICLE, 40 MPH EACH VEHICLE

HS-802 128

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: G-BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE 90° IMPACT INTO STATIONARY
VEHICLE (40 MPH)

HS-802 129

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: H-BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE 45° IMPACT INTO STATIONARY
VEHICLE (40 MPH)

HS-802 130

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: I-BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE PERPENDICULAR, 40 MPH EACH
CAR

HS-802 131

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: J-BASE VEHICLE TYPE OF TEST:
FRONT-TO-SIDE 45°, 40 MPH EACH CAR

HS-802 132

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: L (BASE VEHICLE). TYPE OF TEST:
REAR IMPACT INTO STATIONARY VEHICLE AT 50
MPH

HS-802 133

RESEARCH SAFETY VEHICLE (RSV) CRUSH TEST
REPORT

HS-802 121

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REPORT

HS-802 124

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HS-019 365

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TY OF 1/25 SCALE AUTOMOBILE AERODYNAMIC
TESTING

HS-019 731

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HS-019 752

ON-BOARD COMPUTER TESTING 0VEHICLE OVER-
THE-ROAD TESTS0

HS-019 708

SOME RECENT TRENDS IN HUMAN FACTORS TEST-
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HS-019 733

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ON-BOARD COMPUTER TESTING 0VEHICLE OVER-
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HS-019 708

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HIGHWAY ACCIDENT REPORT. SURTIGAS, S.A.,
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HS-019 673

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APPLICATION OF FUEL SPRAY THEORY TO EX-
HAUST EMISSION CONTROL IN A D.I. 0DIRECT IN-
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HS-019 745

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DICAPPED DRIVER

HS-019 703

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HS-020 007
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HS-802 053
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HS-019 694
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HS-020 008
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TRADEOFFS ASSOCIATED WITH POSSIBLE AUTO EMISSION STANDARDS. A REPORT TO THE ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY
HS-020 014
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AN ANALYSIS OF THE IMPACT OF ASAP 0ALCOHOL SAFETY ACTION PROJECT0 ON THE TRAFFIC SAFETY SYSTEM
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AN ANALYSIS OF THE IMPACT OF ASAP (ALCOHOL SAFETY ACTION PROJECT) ON THE TRAFFIC SAFETY SYSTEM
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HS-802 058
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HS-802 085
STABILITY CONSIDERATIONS IN THE MATHEMATICAL RECONSTRUCTION OF TRAFFIC ACCIDENTS
HS-019 987
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HIGHWAY ACCIDENT REPORT. FRANCISCO FLORES TRUCK/PICKUP TRUCK WITH CAMPER AND TRAILER COLLISION, U.S. ROUTE 395, BISHOP, CALIFORNIA, JUNE 29, 1974

HS-019 682

TRAIN

RAILROAD/HIGHWAY ACCIDENT REPORT. COLLISION OF A CROWN-TRYGG CONSTRUCTION COMPANY TRUCK WITH AN AMTRAK PASSENGER TRAIN, ELWOOD, ILLINOIS, NOVEMBER 19, 1975

HS-019 679

TRANSCRIPT

MOTOR VEHICLE SAFETY SEMINAR. KEY ISSUES IN HEAVY TRUCK SAFETY. TRANSCRIPT OF PROCEEDINGS, JULY 12, 1976

HS-802 114

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLICY, POLITICS AND MOTOR VEHICLE SAFETY STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY 14, 1976

HS-802 116

MOTOR VEHICLE SAFETY SEMINAR. RESTRAINT SYSTEM EFFECTIVENESS. TRANSCRIPT OF PROCEEDINGS, JULY 13, 1976

HS-802 115

NATIONAL MOTOR VEHICLE SAFETY ADVISORY COUNCIL MEETING, JULY 15, 1976. STENOGRAPHIC TRANSCRIPT OF HEARINGS

HS-802 117

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DESIGNING EXHAUST PORTS FOR LOW HEAT TRANSFER

HS-020 036

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MOTOR CARRIER ACCIDENT INVESTIGATION. TRI-STATE MOTOR TRANSIT COMPANY, INC. ACCIDENT - FEBRUARY 13, 1976 - GILA BEND, ARIZONA

HS-020 001

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JOINING DISSIMILAR METALS WITH TRANSITION MATERIALS

HS-020 035

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A MECHANICAL TORQUE CONVERTER, AND ITS USE AS AN AUTOMOBILE TRANSMISSION

HS-020 022

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HS-019 748

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STRATEGIES FOR REDUCING GASOLINE CONSUMPTION THROUGH IMPROVED MOTOR VEHICLE EFFICIENCY. A REPORT OF AN INFORMAL TRANSPORTATION RESEARCH BOARD WORKSHOP

HS-020 002

TAKING A SOUND APPROACH TO TRANSPORTATION SAFETY. A SUGGESTION FOR REDUCING ACCIDENTS OUTSIDE THE SCHOOL BUS

HS-019 709

THE EFFECTIVENESS OF MILES-PER-GALLON METERS AS A MEANS TO CONSERVE GASOLINE IN AUTOMOBILES. REPORT TO THE CONGRESS AND THE PRESIDENT FROM THE SECRETARY OF TRANSPORTATION

HS-020 016

VISION AND TRANSPORTATION. A BIBLIOGRAPHY ON THE VISUAL ASPECTS OF HIGHWAY AND AIR TRAVEL

HS-019 972

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AN INTRODUCTION TO THE UNDERSTANDING OF BLUNT CHEST TRAUMA

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TRAVEL

VISION AND TRANSPORTATION. A BIBLIOGRAPHY ON THE VISUAL ASPECTS OF HIGHWAY AND AIR TRAVEL

HS-019 972

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THE RESULTS OF THE CUMBERLAND/YORK (MAINE) ASAP (ALCOHOL SAFETY ACTION PROJECT) REHABILITATION COUNTERMEASURES IN TERMS OF ARREST AND CRASH RECIDIVISM OF 833 DRINKER DRIVERS CONTACTED AND/OR TREATED IN 1973

HS-019 712

TREATMENT

EFFECT OF TWO WEEKS' TREATMENT WITH CHLORDIAZEPOXIDE OR FLUPENTHIXOLE, ALONE OR IN COMBINATION WITH ALCOHOL, ON PSYCHOMOTOR SKILLS RELATED TO DRIVING

HS-019 704

TRENDS

ENGINE DEVELOPMENTS AND AGRICULTURAL EQUIPMENT FUEL CONSUMPTION TRENDS

HS-019 663

SOME RECENT TRENDS IN HUMAN FACTORS TESTING

HS-019 733

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A STUDY TO DETERMINE THE CAUSES OF ACCIDENTS: AN IN-DEPTH CASE REPORT CASE NO. TAC-SP-75-6, SCHOOL BUS/GARBAGE TRUCK-ACUTE OBLIQUE. FINAL REPORT

HS-802 056

HIGHWAY ACCIDENT REPORT. COLLISION OF HUBERT ROTEN TRUCKING COMPANY TRUCK AND SKINNER CORPORATION BUS, NEAR HAMILTON, GEORGIA, JUNE 6, 1975

HS-019 676

HIGHWAY ACCIDENT REPORT. DEATON COMPANY INCORPORATED. TRUCK/AUTOMOBILE COLLISION, CHATTAHOOCHEE RIVER BRIDGE, I-20, ATLANTA, GEORGIA. AUGUST 21, 1973

HS-019 683

HIGHWAY ACCIDENT REPORT. FRANCISCO FLORES TRUCK/PICKUP TRUCK WITH CAMPER AND TRAILER COLLISION, U.S. ROUTE 395, BISHOP, CALIFORNIA, JUNE 29, 1974

HS-019 682

HIGHWAY ACCIDENT REPORT. HOPPY'S OIL SERVICE, INC., TRUCK OVERTURN AND FIRE, STATE ROUTE 128, BRAINTREE, MASSACHUSETTS, OCTOBER 18, 1973

HS-019 684

HIGHWAY ACCIDENT REPORT. IMMIGRATION AND NATURALIZATION SERVICE MULTIPURPOSE VEHICLE/T.R. PRODUCE COMPANY TRUCK COLLISION, NEAR EL CENTRO, CALIFORNIA, MARCH 8, 1974

HS-019 681

MOTOR VEHICLE SAFETY SEMINAR. KEY ISSUES IN HEAVY TRUCK SAFETY. TRANSCRIPT OF PROCEEDINGS, JULY 12, 1976

HS-802 114

RAILROAD/HIGHWAY ACCIDENT REPORT. COLLISION OF A CROWN-TRYGG CONSTRUCTION COMPANY TRUCK WITH AN AMTRAK PASSENGER TRAIN, ELWOOD, ILLINOIS, NOVEMBER 19, 1975

HS-019 679

THE NOISE AND TRACTION CHARACTERISTICS OF BIAS PLY TRUCK TIRES. VOL. 1 NOISE AND DRY TRACTION FINDINGS

HS-019 693

THE NOISE AND TRACTION CHARACTERISTICS OF BIAS-PLY TRUCK TIRES. VOL. 2. WET TRACTION FINDINGS

HS-019 694

TRUCKING

HIGHWAY ACCIDENT REPORT. COLLISION OF HUBERT ROTEN TRUCKING COMPANY TRUCK AND SKINNER CORPORATION BUS, NEAR HAMILTON, GEORGIA, JUNE 6, 1975

HS-019 676

TRYGG

RAILROAD/HIGHWAY ACCIDENT REPORT. COLLISION OF A CROWN-TRYGG CONSTRUCTION COMPANY TRUCK WITH AN AMTRAK PASSENGER TRAIN, ELWOOD, ILLINOIS, NOVEMBER 19, 1975

HS-019 679

TURBULENCE

INLET VALVE THROTTLING AND THE EFFECTS OF MIXTURE PREPARATION AND TURBULENCE ON THE EXHAUST GAS EMISSIONS OF A SPARK IGNITION ENGINE

HS-020 025

TURBULENT

EMISSIONS AND FUEL ECONOMY OF THE TURBULENT FLOW SYSTEM FOR EUROPEAN 4-CYL ENGINES

HS-019 666

TYPE

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: RSV TEST NO. 2. TYPE OF TEST: PLYMOUTH FURY VS. RSV, 90° SIDE IMPACT, 32 MPH IMPACT SPEED

HS-802 123

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: A-BASE VEHICLE. TYPE OF TEST: BARRIER CRASH (45 MPH)

HS-802 125

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: MOD. B (MODIFIED BASELINE VEHICLE). TYPE OF TEST: BARRIER CRASHES (NO DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

HS-802 126

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: C (BASE VEHICLE). TYPE OF TEST: BARRIER CRASH (35 MPH)

HS-802 127

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: F-BASE VEHICLE. TYPE OF TEST: CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH VEHICLE, 40 MPH EACH VEHICLE

HS-802 128

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: G-BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 90° IMPACT INTO STATIONARY VEHICLE (40 MPH)

HS-802 129

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: H-BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE 45° IMPACT INTO STATIONARY VEHICLE (40 MPH)

HS-802 130

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: I-BASE VEHICLE. TYPE OF TEST: FRONT-TO-SIDE PERPENDICULAR, 40 MPH EACH CAR

HS-802 131

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: J-BASE VEHICLE TYPE OF TEST: FRONT-TO-SIDE 45°, 40 MPH EACH CAR

HS-802 132

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: L (BASE VEHICLE). TYPE OF TEST: REAR IMPACT INTO STATIONARY VEHICLE AT 50 MPH

HS-802 133

ULTIMATE

AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES TO DETERMINE TOTAL PROJECT IMPACT

HS-019 717

MAINE ASAP 0ALCOHOL SAFETY ACTION PROJECT: YORK AND CUMBERLAND COUNTIES. KEY ANALYTIC STUDY. AN ANALYSIS OF ULTIMATE PERFORMANCE MEASURES

HS-019 713

MAINE ASAP 0ALCOHOL SAFETY ACTION PROJECT: YORK AND CUMBERLAND COUNTIES. KEY ANALYTIC STUDY. AN ANALYSIS OF ULTIMATE MEASURES. UPDATED

HS-019 714

UNBUCKLING

UNBUCKLING THE SEAT BELT MYSTERY

HS-019 689

UNION

HIGHWAY ACCIDENT REPORT. SISKIYOU UNION HIGH SCHOOL DISTRICT SCHOOLBUS/AUTOMOBILE COLLISION AND ROLLOVER, I-5, ASHLAND OREGON, MAY 9, 1975

HS-019 680

UNIQUE

GM 980X - A UNIQUE HIGH STRENGTH SHEET
STEEL WITH SUPERIOR FORMABILITY

HS-019 737

UPDATED

MAINE ASAP 0ALCOHOL SAFETY ACTION PRO-
JECT0: YORK AND CUMBERLAND COUNTIES. KEY
ANALYTIC STUDY. AN ANALYSIS OF ULTIMATE
MEASURES. UPDATED

HS-019 714

USAGE

SAFETY BELT USAGE. A REVIEW OF EFFECTIVE-
NESS STUDIES. SUGGESTIONS FOR STATE PRO-
GRAMS

HS-801 988

VALIDITY

A PARAMETRIC INVESTIGATION OF THE VALIDI-
TY OF 1/25 SCALE AUTOMOBILE AERODYNAMIC
TESTING

HS-019 731

VALIDITY TEST OF NEW YORK STATE INJURY COD-
ING SCHEME (NYSICS)

HS-019 365

VALVE

INLET VALVE THROTTLING AND THE EFFECTS OF
MIXTURE PREPARATION AND TURBULENCE ON
THE EXHAUST GAS EMISSIONS OF A SPARK IGNI-
TION ENGINE

HS-020 025

VAPOURIZATION

FUEL VAPOURIZATION. ECONOMY WITH REDUCED
EXHAUST EMISSION

HS-020 024

VARIABLE

AN AUTOMOTIVE CVT 0CONTINUOUSLY VARIABLE
TRANSMISSION0

HS-019 748

VEHICLE

A CRITICAL REVIEW OF FEDERAL MOTOR VEHI-
CLE SAFETY STANDARD 105

HS-020 027

CHARGER XL: A LIGHTWEIGHT MATERIALS
DEVELOPMENT VEHICLE

HS-019 734

DYNAMIC BEHAVIOUR OF A ROAD VEHICLE WITH
REAR WHEEL ADAPTIVE BRAKING CONTROL

HS-020 023

ELECTROMAGNETIC INTERFERENCE EFFECTS ON
MOTOR VEHICLE ELECTRONIC CONTROL AND
SAFETY DEVICES. FINAL REPORT. VOL. 1 - SUMMA-
RY

HS-802 107

EMERGENCY CONTROL OF VEHICLE PLATOONS:
CONTROL OF FOLLOWING-LAW VEHICLES.
SYSTEM OPERATION AND PLATOON LEADER CON-
TROL

HS-019 993

HIGHWAY ACCIDENT REPORT. IMMIGRATION AND
NATURALIZATION SERVICE MULTIPURPOSE VEHI-

CLE/T.R. PRODUCE COMPANY TRUCK COLLISION
NEAR EL CENTRO, CALIFORNIA, MARCH 8, 1974

HS-019 68

MOTOR VEHICLE SAFETY SEMINAR. KEY ISSUE
IN HEAVY TRUCK SAFETY. TRANSCRIPT OF
PROCEEDINGS, JULY 12, 1976

HS-802 11

MOTOR VEHICLE SAFETY SEMINAR. PUBLIC POLI-
CY, POLITICS AND MOTOR VEHICLE SAFETY
STANDARDS. TRANSCRIPT OF PROCEEDINGS, JULY
14, 1976

HS-802 11

MOTOR VEHICLE SAFETY SEMINAR. RESTRAIN-
SYSTEM EFFECTIVENESS. TRANSCRIPT OF
PROCEEDINGS, JULY 13, 1976

HS-802 11

NATIONAL MOTOR VEHICLE SAFETY ADVISOR
COUNCIL MEETING, JULY 15, 1976. STENOGRAPHIC
TRANSCRIPT OF HEARINGS

HS-802 11

ON-BOARD COMPUTER TESTING 0VEHICLE OVER-
THE-ROAD TESTS0

HS-019 70

RELATING PAVEMENT ROUGHNESS TO VEHICLE
BEHAVIOR. FINAL REPORT

HS-019 95

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. RSV TEST NO. 1. RSV VS. HONDA, HEAD-
ON FRONTAL IMPACT, 30 MPH EACH VEHICLE

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: RSV TEST NO. 2. TYPE OF TEST:
PLYMOUTH FURY VS. RSV, 90° SIDE IMPACT, 30
MPH IMPACT SPEED

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: A-BASE VEHICLE. TYPE OF TEST:
BARRIER CRASH (45 MPH)

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: MOD. B (MODIFIED BASELINE VEHI-
CLE). TYPE OF TEST: BARRIER CRASHES (N
DAMAGE - 5 MPH FOLLOWED BY 35 MPH)

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: C (BASE VEHICLE). TYPE OF TEST:
BARRIER CRASH (35 MPH)

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: F--BASE VEHICLE. TYPE OF TEST:
CAR-TO-CAR OFFSET, ONE HALF WIDTH EACH
VEHICLE, 40 MPH EACH VEHICLE

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: G--BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE 90° IMPACT INTO STATIONARY
VEHICLE (40 MPH)

HS-802 12

RESEARCH SAFETY VEHICLE (RSV) CRASH TEST
REPORT. TEST: H--BASE VEHICLE. TYPE OF TEST:
FRONT-TO-SIDE 45° IMPACT INTO STATIONARY
VEHICLE (40 MPH)

HS-802 12

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: J-BASE VEHICLE TYPE OF TEST: FRONT-TO-SIDE 45°, 40 MPH EACH CAR

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RESEARCH SAFETY VEHICLE (RSV) CRASH TEST REPORT. TEST: L (BASE VEHICLE). TYPE OF TEST: REAR IMPACT INTO STATIONARY VEHICLE AT 50 MPH

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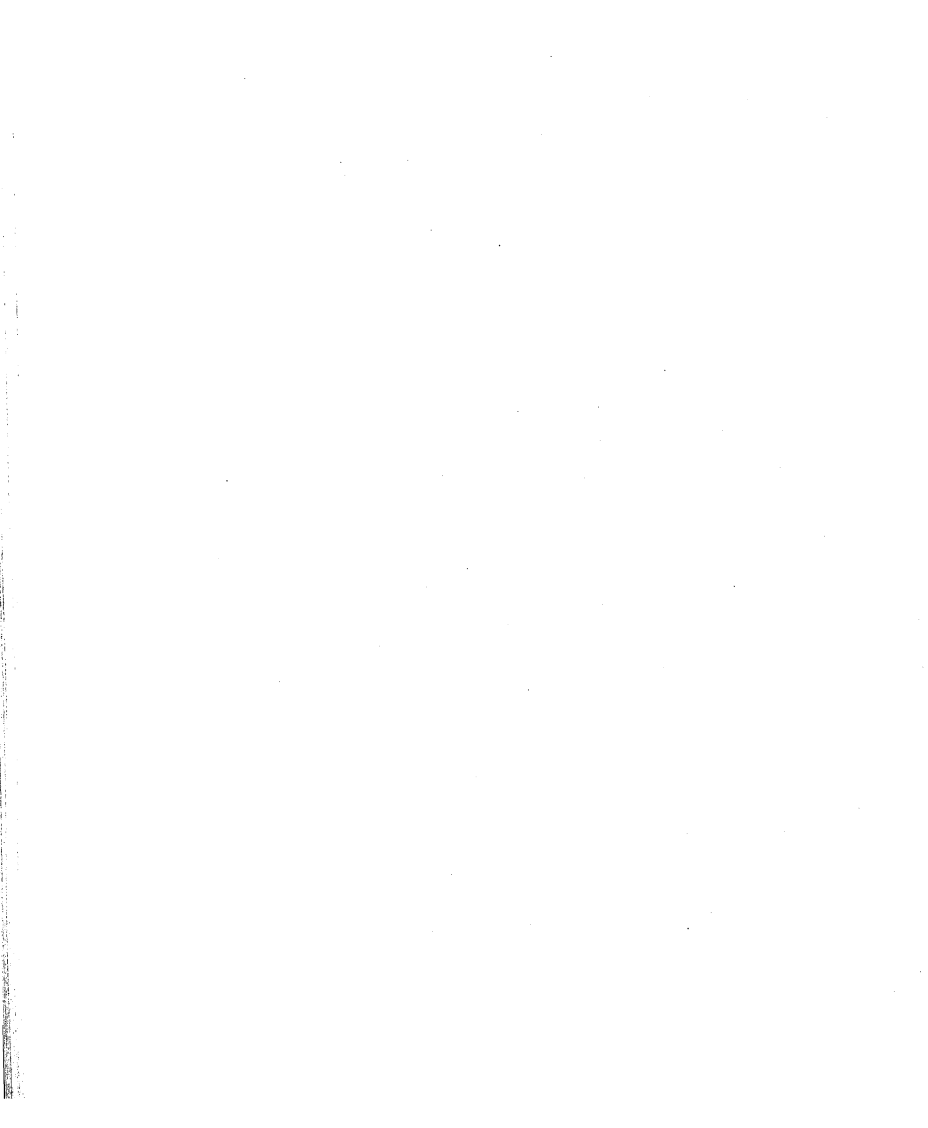
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